

Fig.1

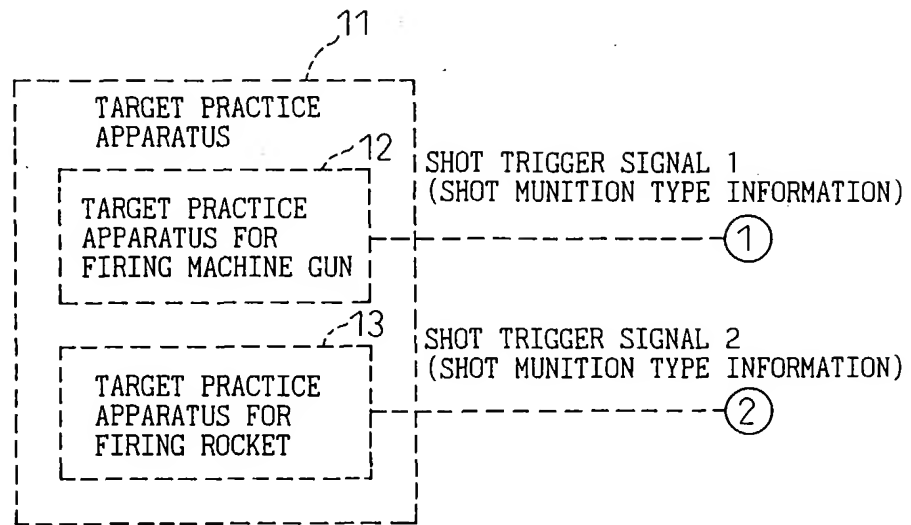
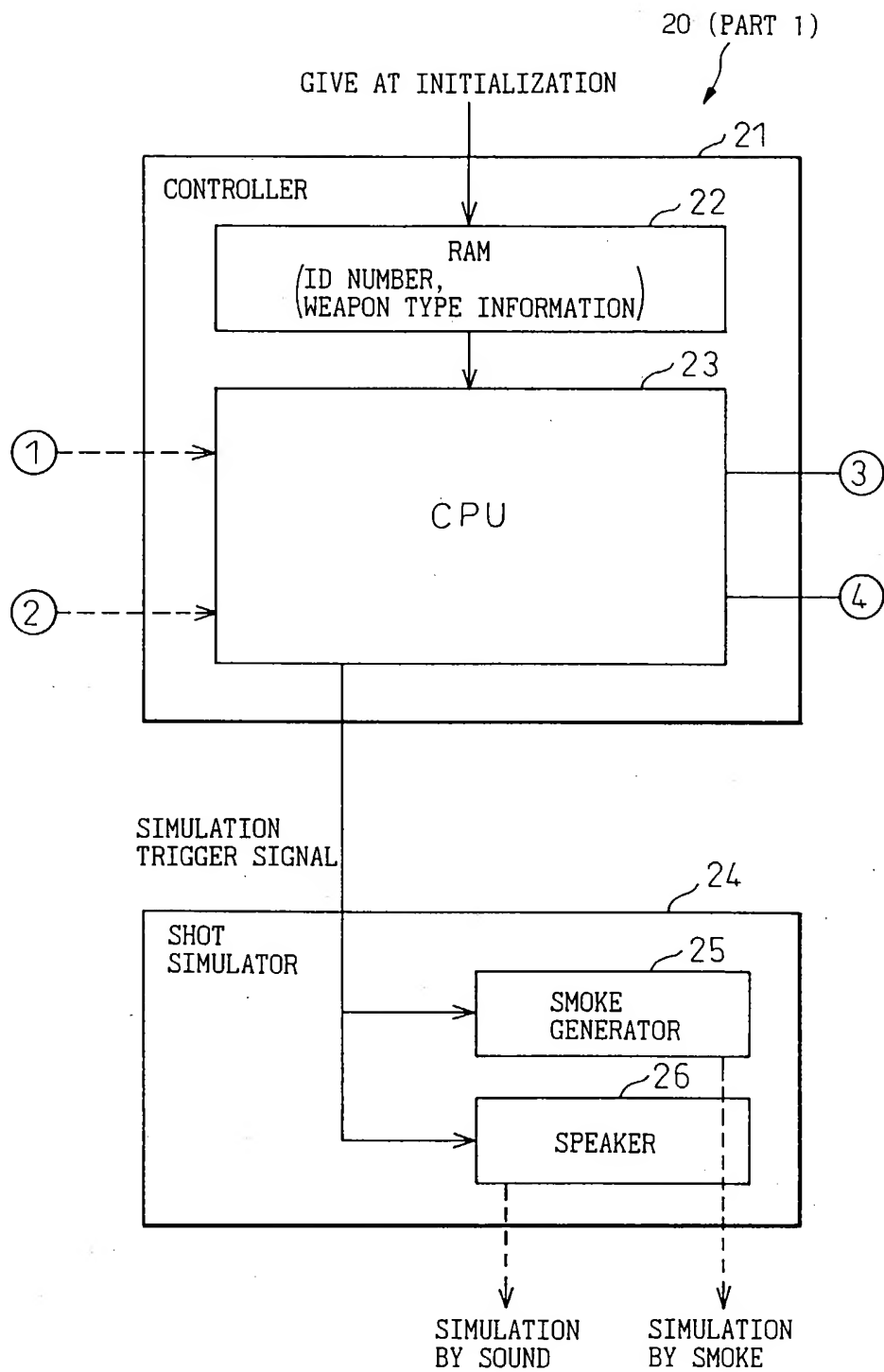


Fig. 2



# Fig. 3

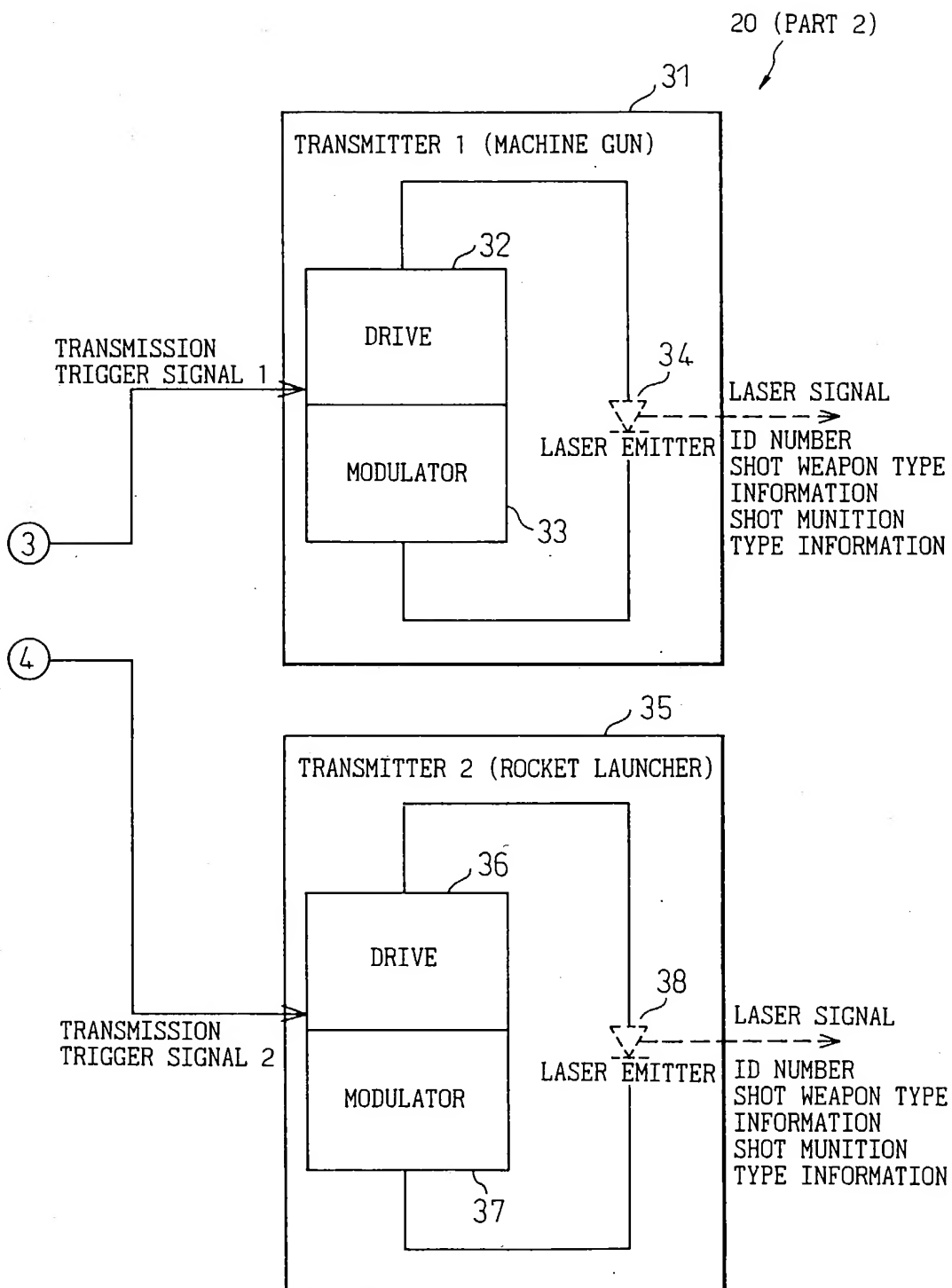


Fig.4

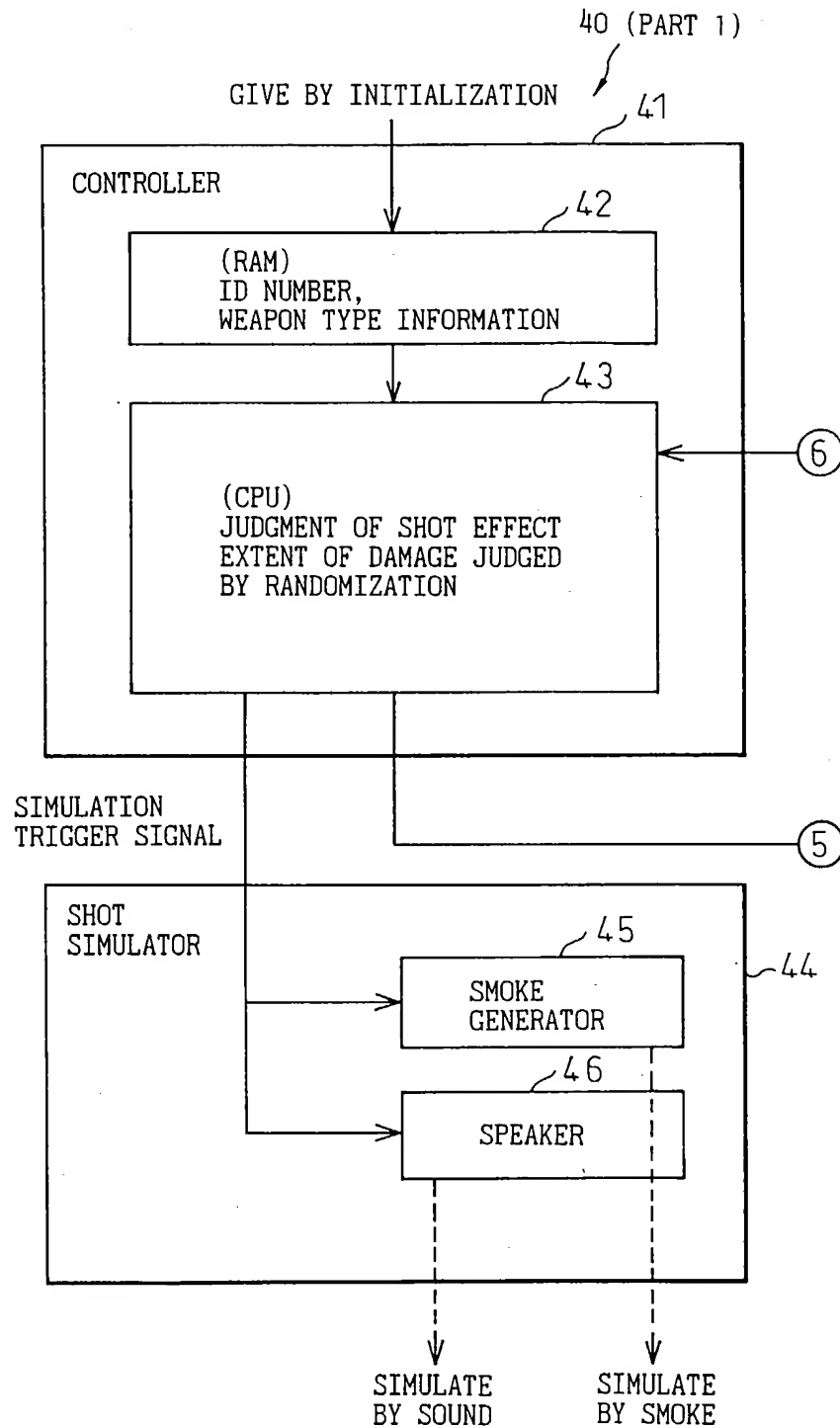


Fig. 5

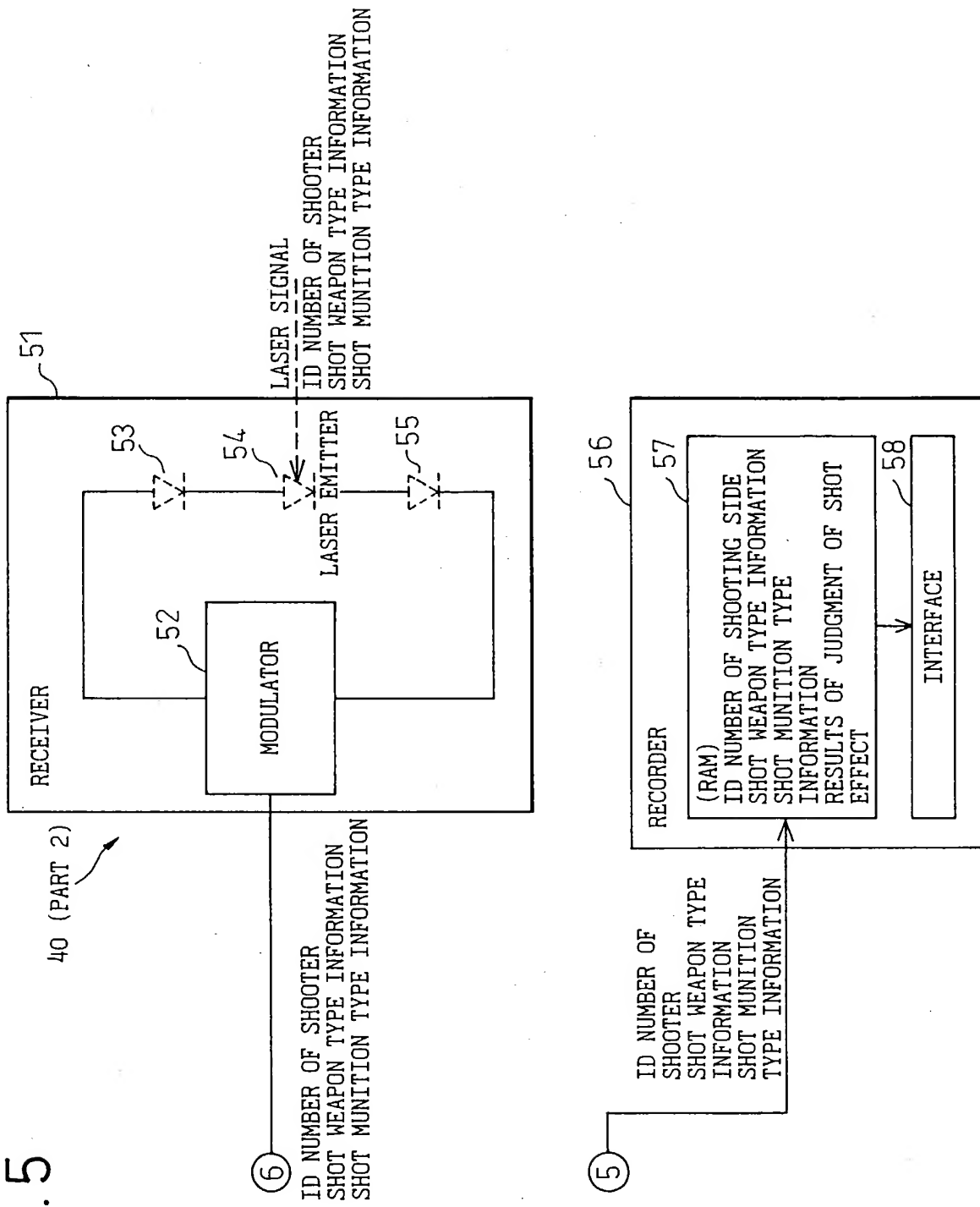
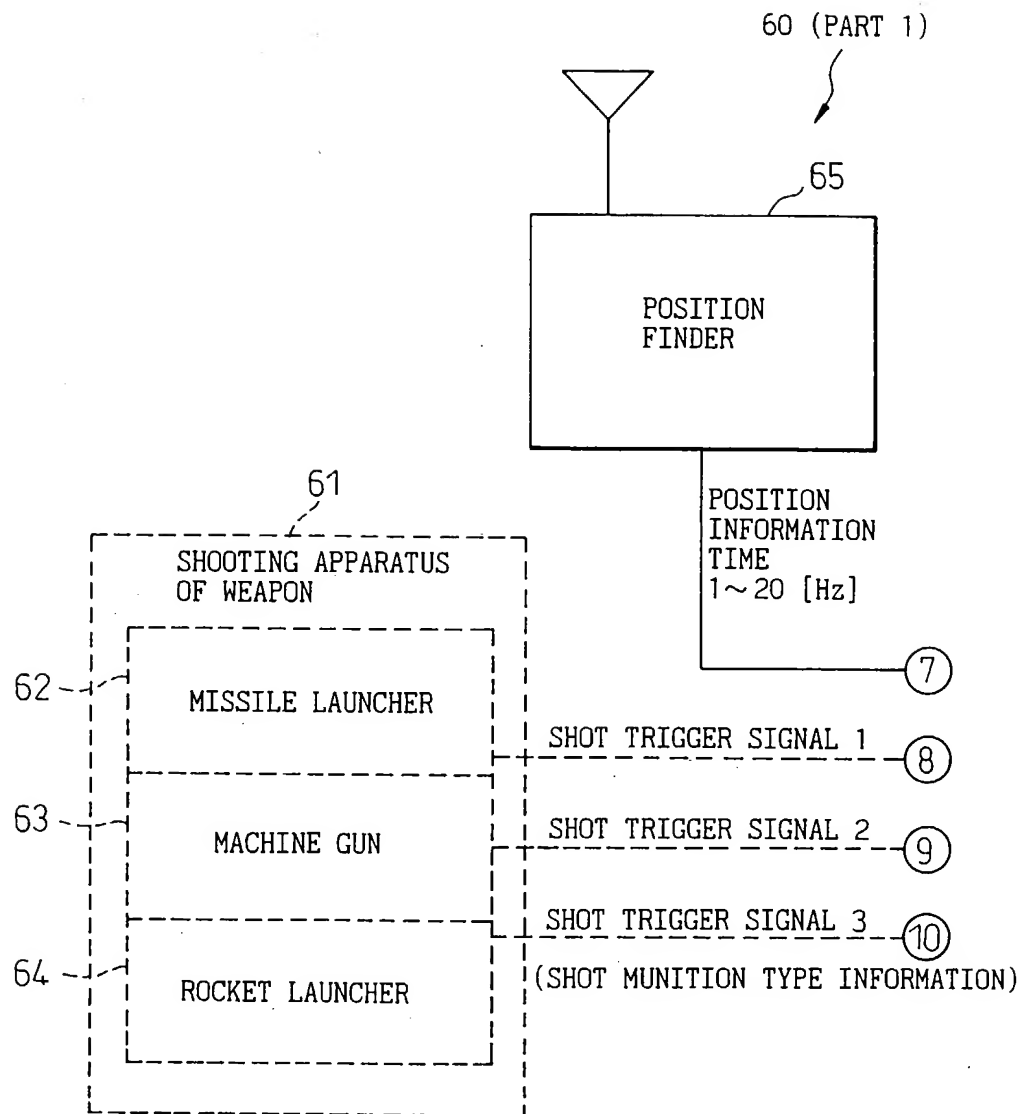
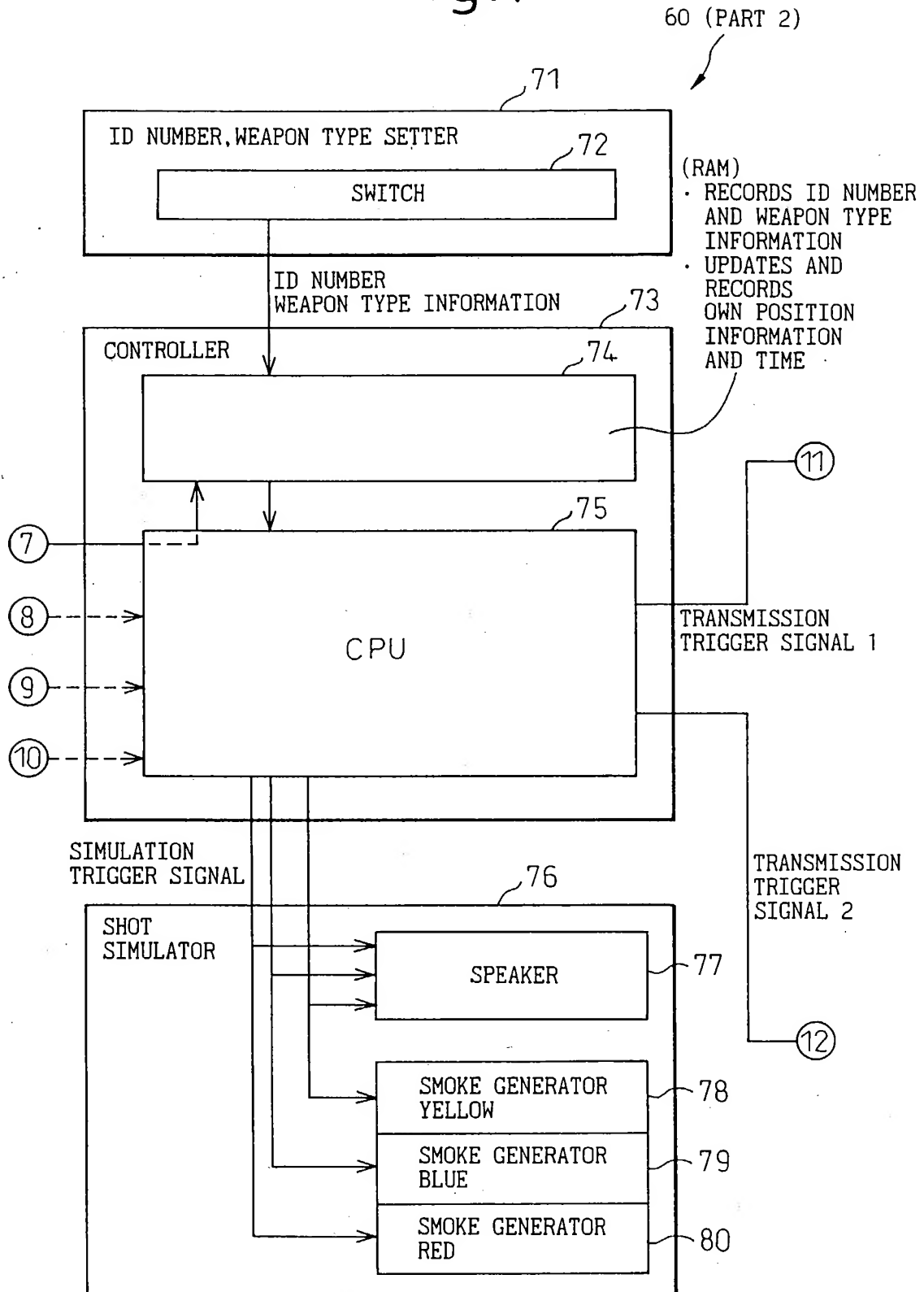


Fig.6



# Fig.7



# Fig.8

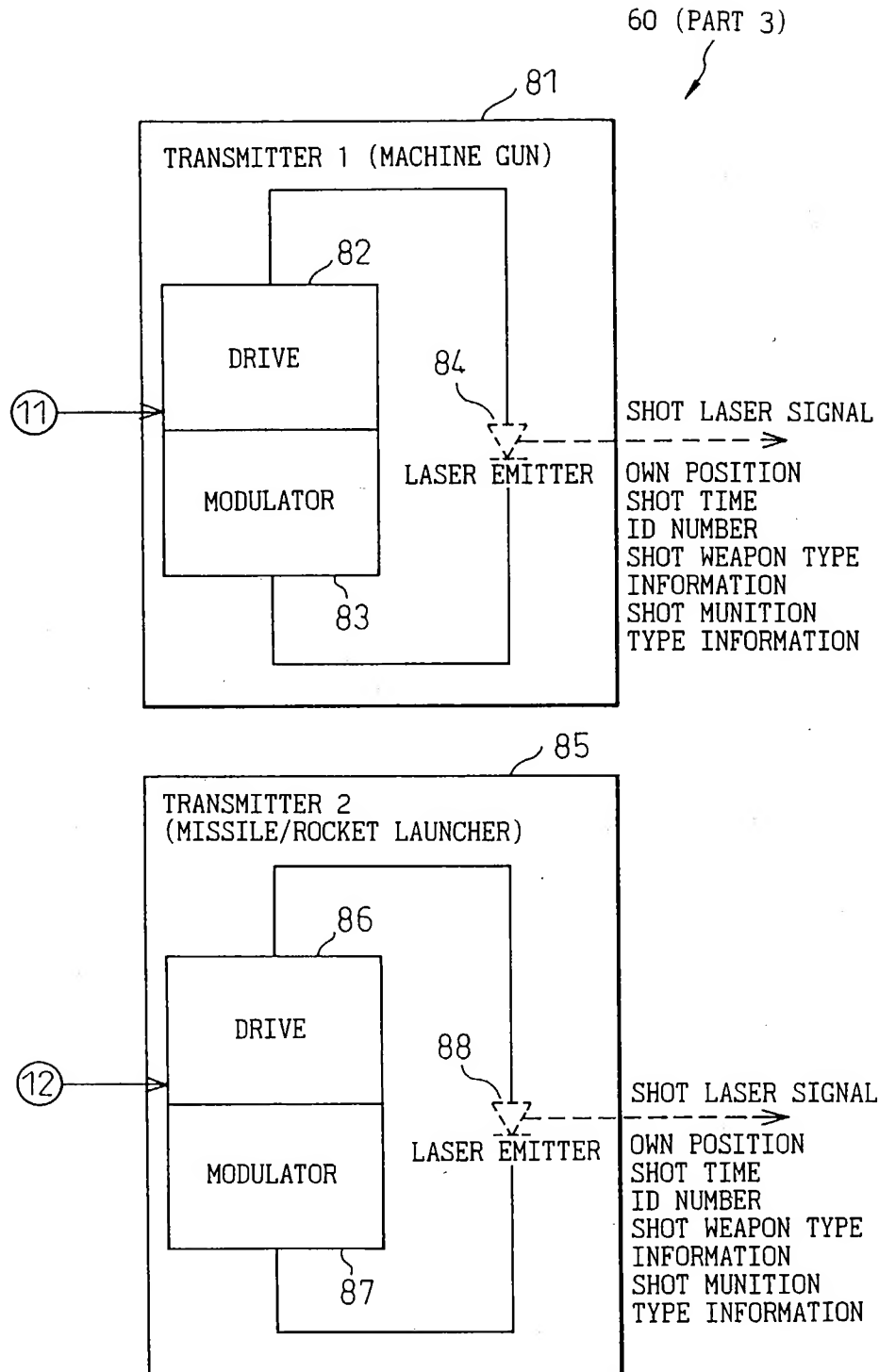
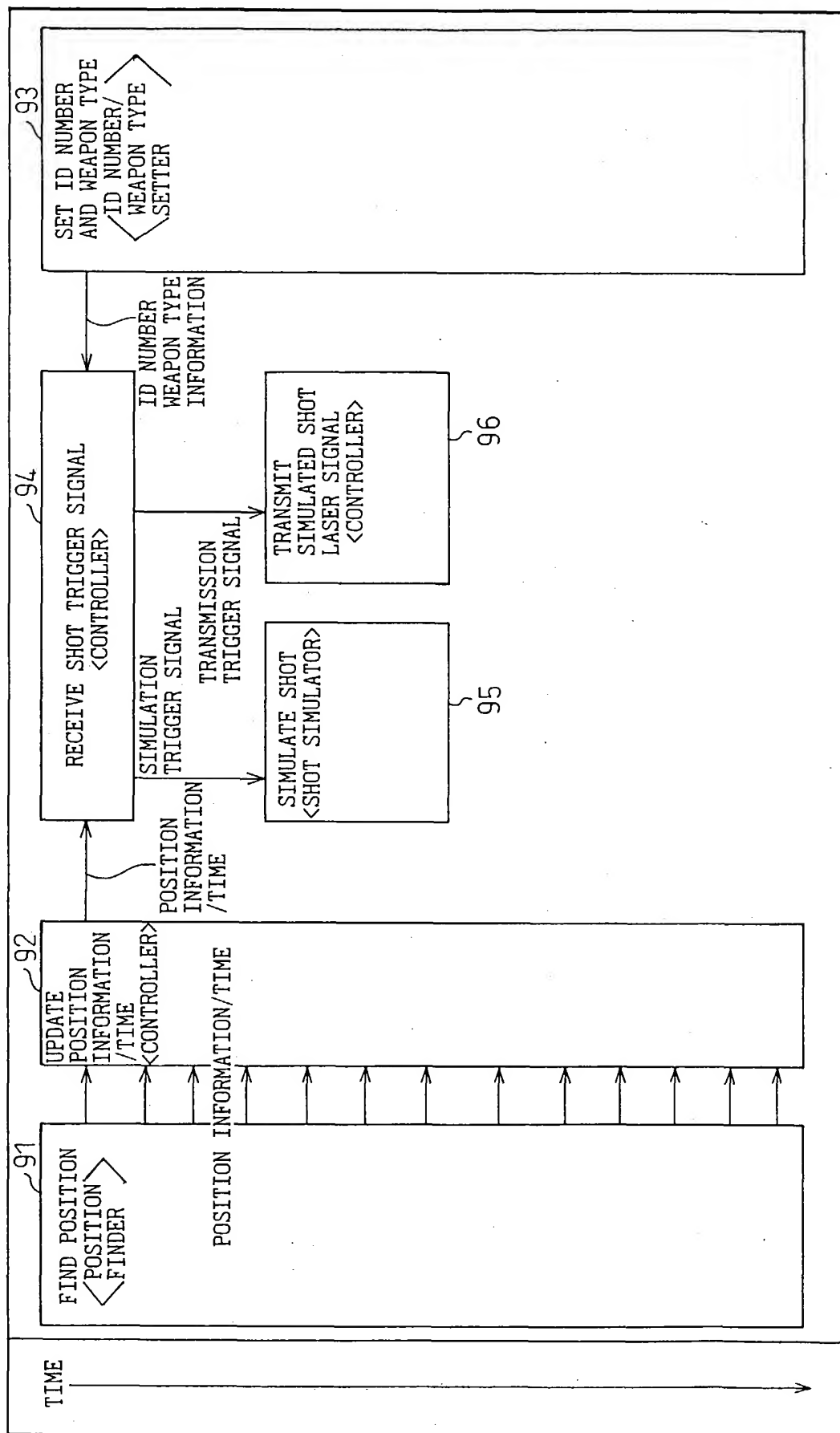




Fig. 9



# Fig.10

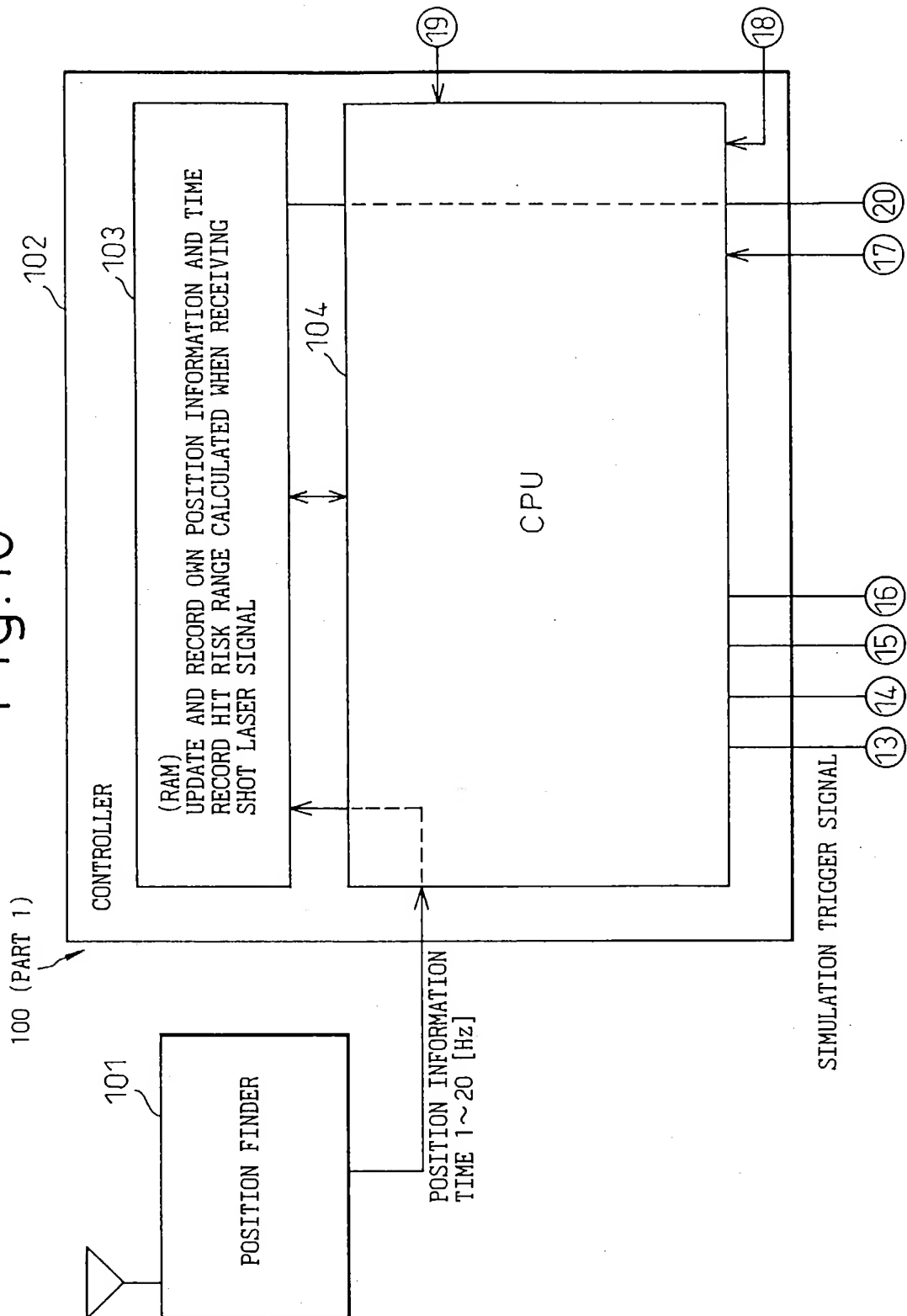
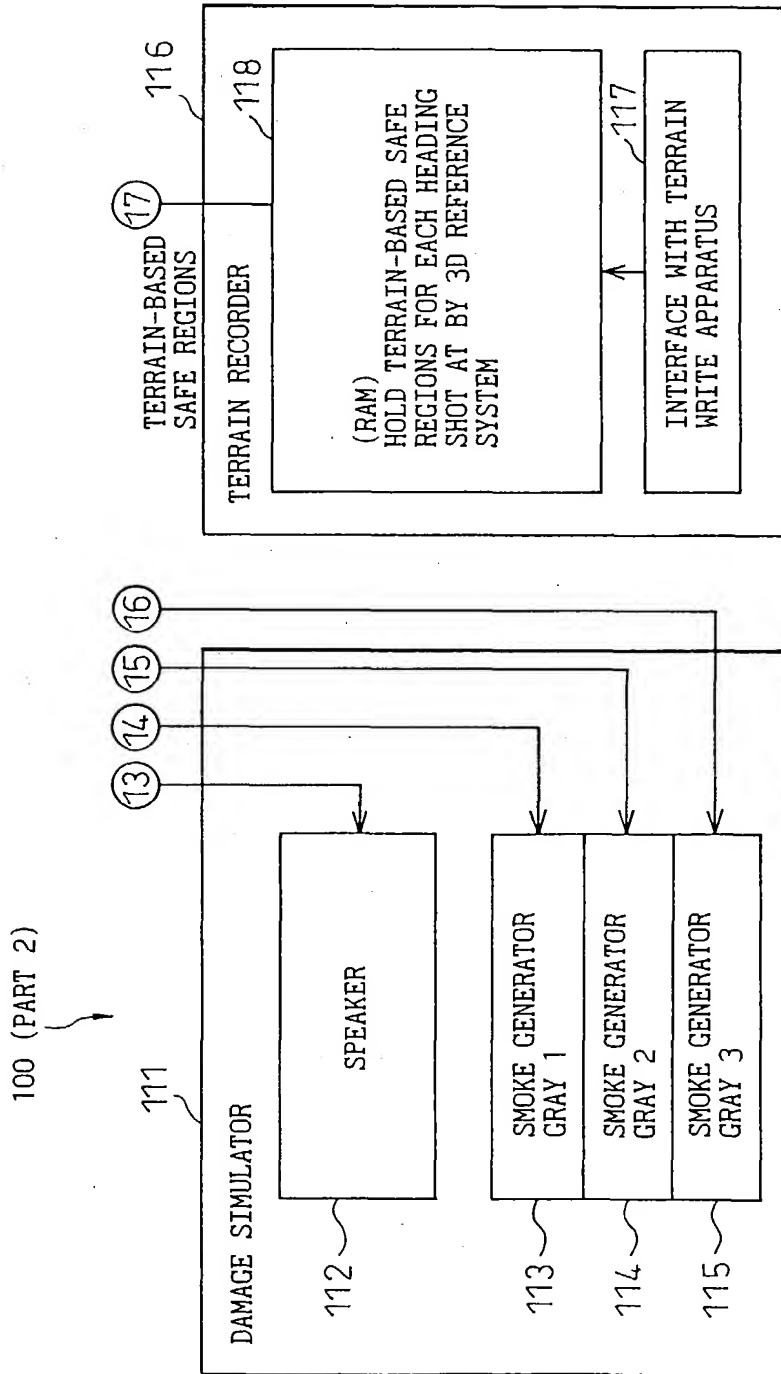


Fig.11



# Fig.12

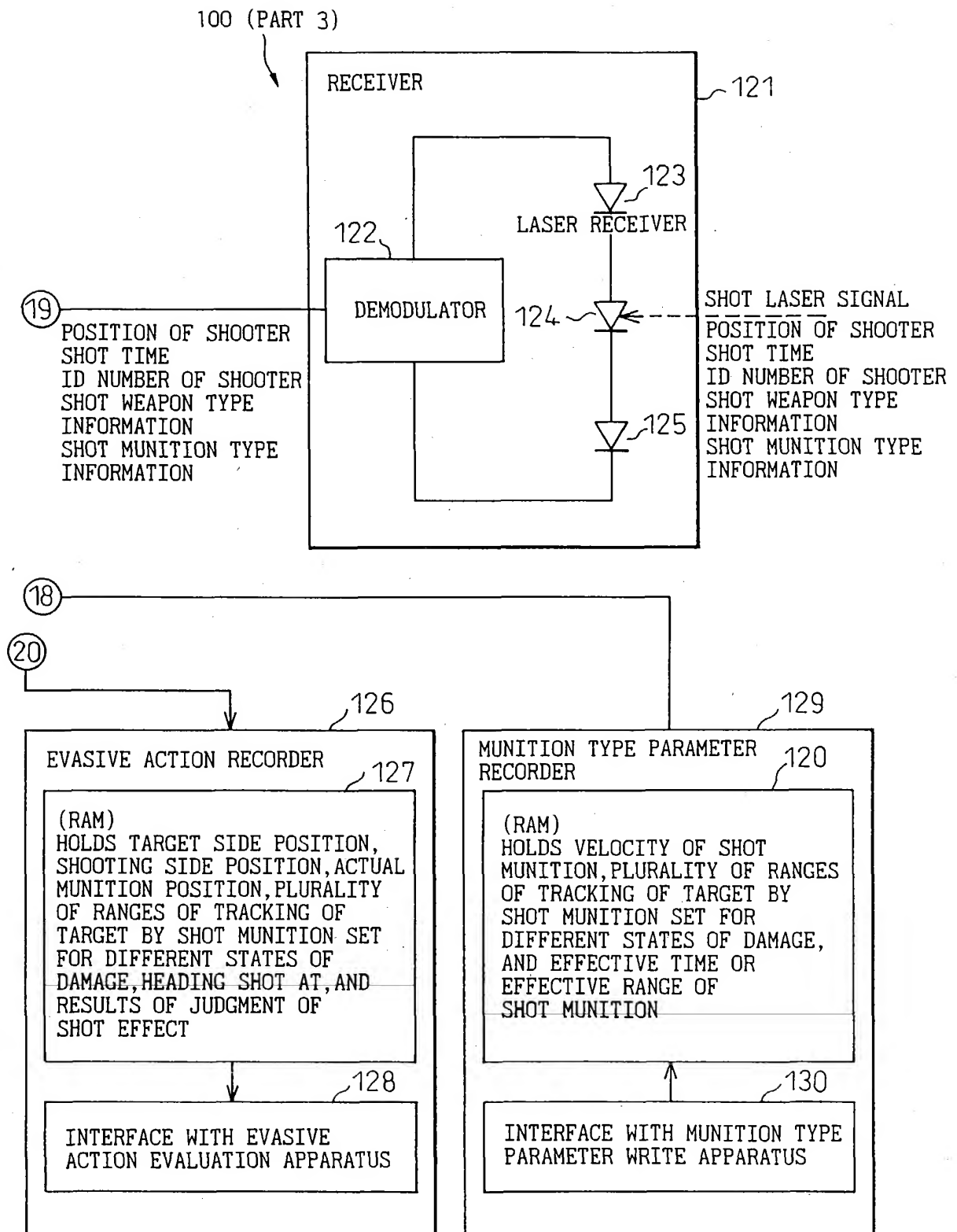


Fig.13

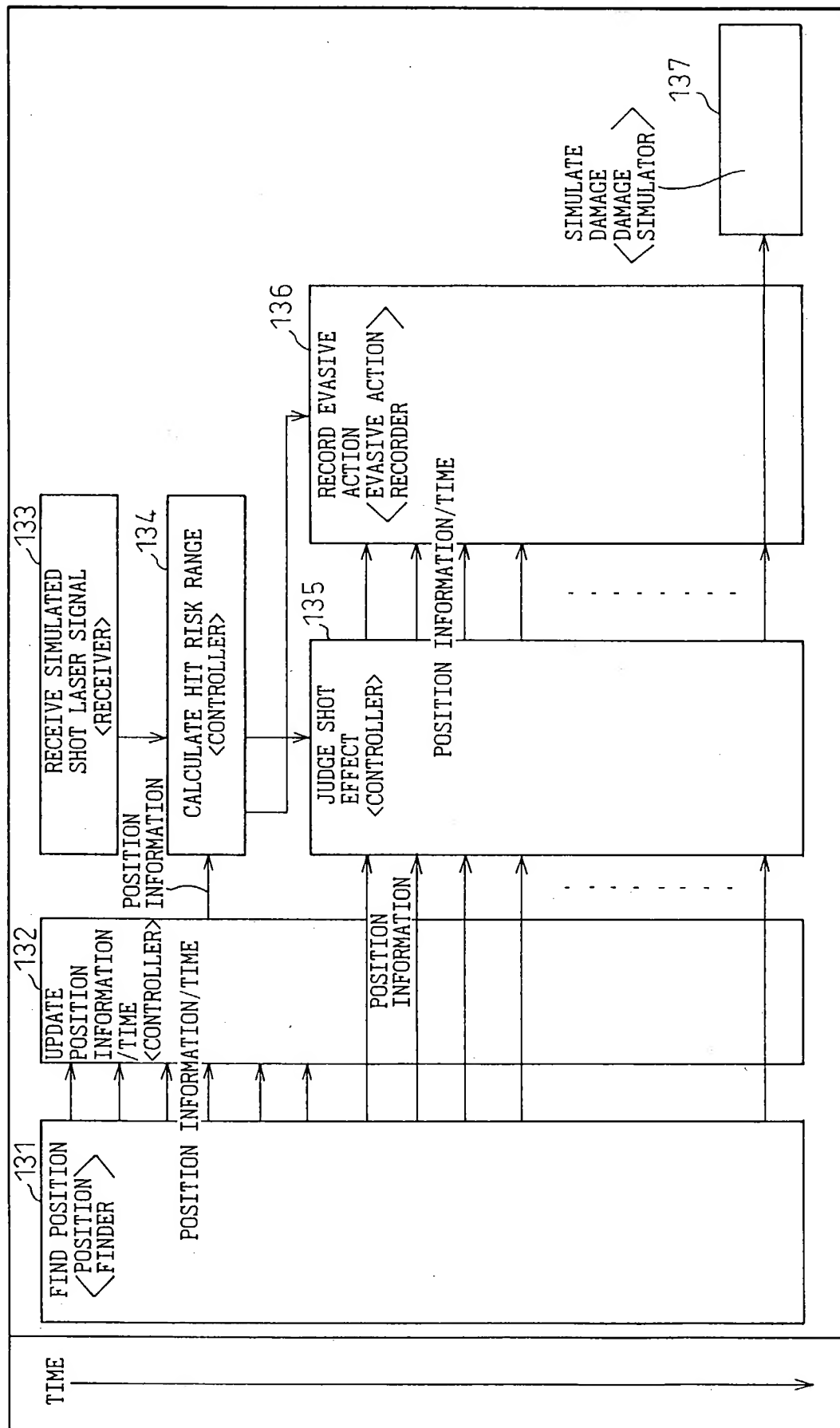


Fig.14

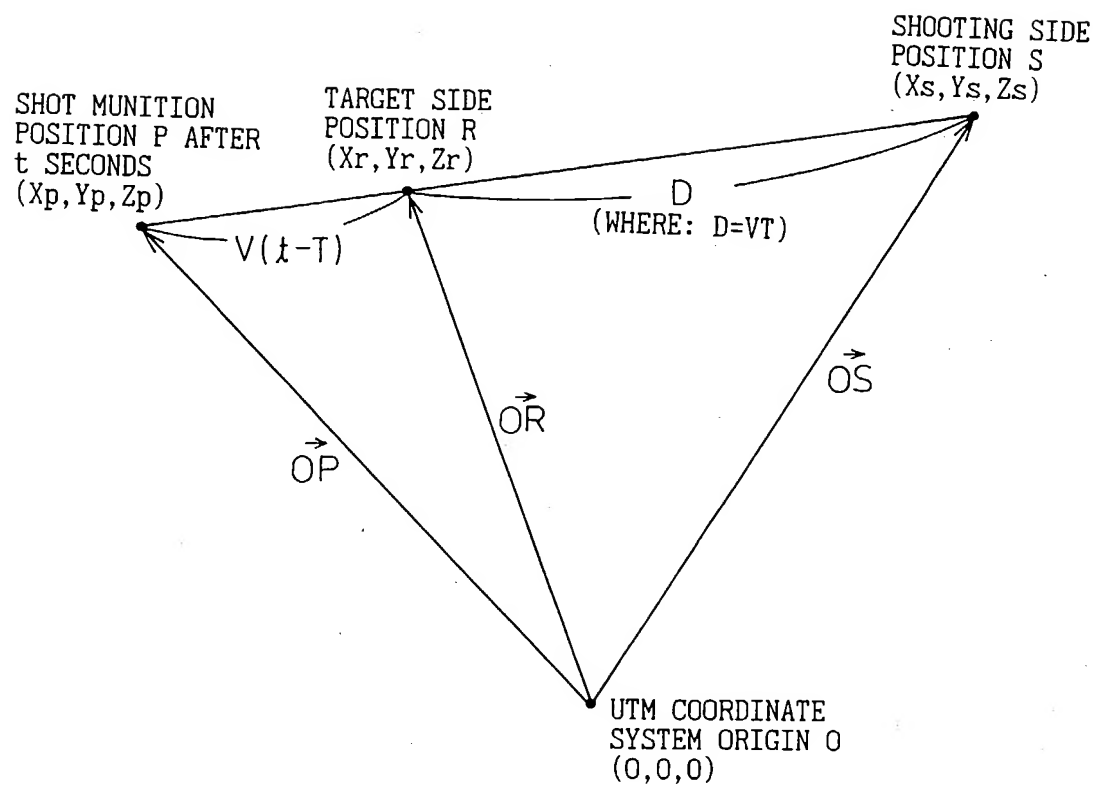
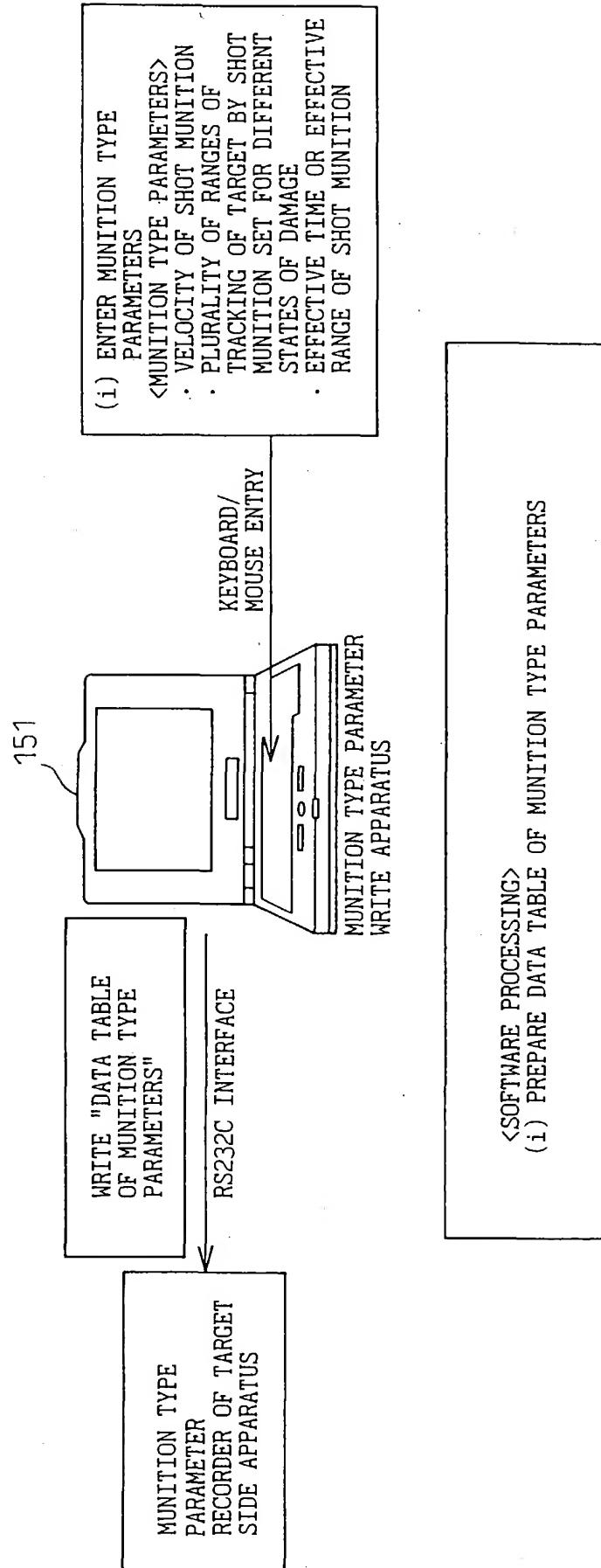


Fig.15



# Fig.16

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CALCULATE DISTANCE D BETWEEN SHOOTING SIDE AND TARGET SIDE IN 3D REFERENCE SYSTEM AT TIME WHEN TARGET SIDE APPARATUS RECEIVES SHOT LASER SIGNAL

$$D = \sqrt{(X_r - X_s)^2 + (Y_r - Y_s)^2 + (Z_r - Z_s)^2}$$



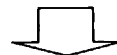
162

CALCULATE EXPECTED POSITION OF SHOT MUNITION FOR EVERY ELAPSE OF TIME FROM TIME WHEN TARGET SIDE APPARATUS RECEIVES SHOT LASER SIGNAL TO EFFECTIVE TIME  $t_e$  OF SHOT MUNITION BASED ON CALCULATED DISTANCE D.

$$\vec{OP} = \frac{\{V(t-T)+D\} \vec{OR} - \{V(t-T)\} \vec{OS}}{-\{V(t-T)\} + \{V(t-T)+D\}}$$

FROM,  
POSITION P ( $X_p, Y_p, Z_p$ ) OF SHOT MUNITION AFTER  $t$  SECONDS AFTER SHOT BECOMES AS FOLLOWS:

$$\begin{cases} X_p = \frac{\{V(t-T)+D\} X_r - \{V(t-T)\} X_s}{-\{V(t-T)\} + \{V(t-T)+D\}} \\ Y_p = \frac{\{V(t-T)+D\} Y_r - \{V(t-T)\} Y_s}{-\{V(t-T)\} + \{V(t-T)+D\}} \\ Z_p = \frac{\{V(t-T)+D\} Z_r - \{V(t-T)\} Z_s}{-\{V(t-T)\} + \{V(t-T)+D\}} \end{cases}$$



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CALCULATE HIT RISK RANGE FOR EVERY ELAPSE OF TIME BASED ON EXPECTED POSITION OF SHOT MUNITION FOR EVERY ELAPSE OF TIME

EXTENT OF DAMAGE

HIT RISK RANGE AFTER  $t$  SECONDS BECOMES AS IN FOLLOWING TABLE FOR EACH STATE OF DAMAGE ( $r_1 > r_2 > r_3 > r_4$ )

	HIT RISK RANGE
NEAR MISS	RANGE OF RADIUS $r_1$ TO $r_2$ ABOUT POSITION P ( $X_p, Y_p, Z_p$ ) OF SHOT MUNITION
SMALL DAMAGE	RANGE OF RADIUS $r_2$ TO $r_3$ ABOUT POSITION P ( $X_p, Y_p, Z_p$ ) OF SHOT MUNITION
MEDIUM DAMAGTE	RANGE OF RADIUS $r_3$ TO $r_4$ ABOUT POSITION P ( $X_p, Y_p, Z_p$ ) OF SHOT MUNITION
LARGE DAMAGE	RANGE OF LESS THAN RADIUS $r_4$ ABOUT POSITION P ( $X_p, Y_p, Z_p$ ) OF SHOT MUNITION



Fig.17

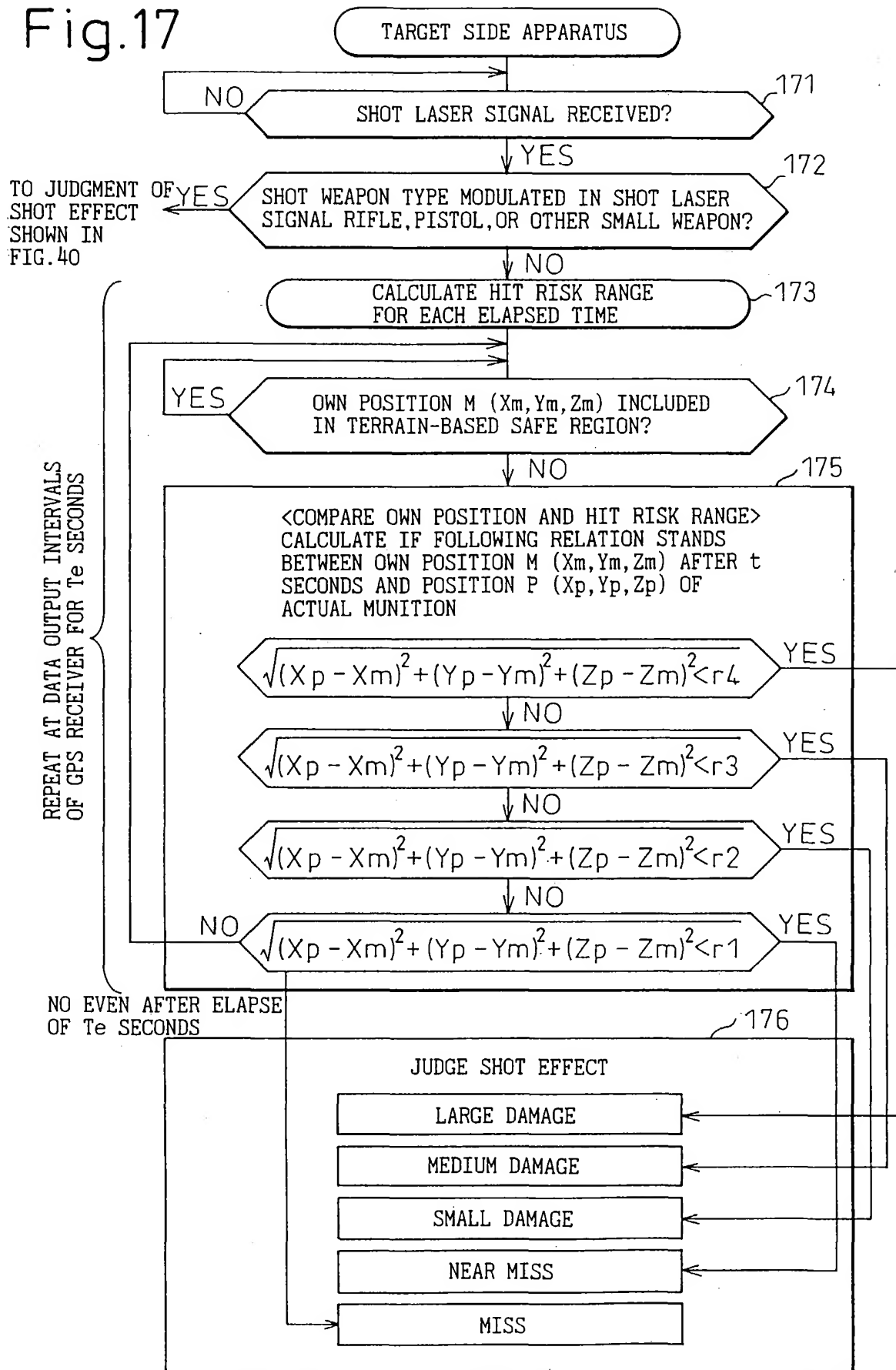


Fig.18

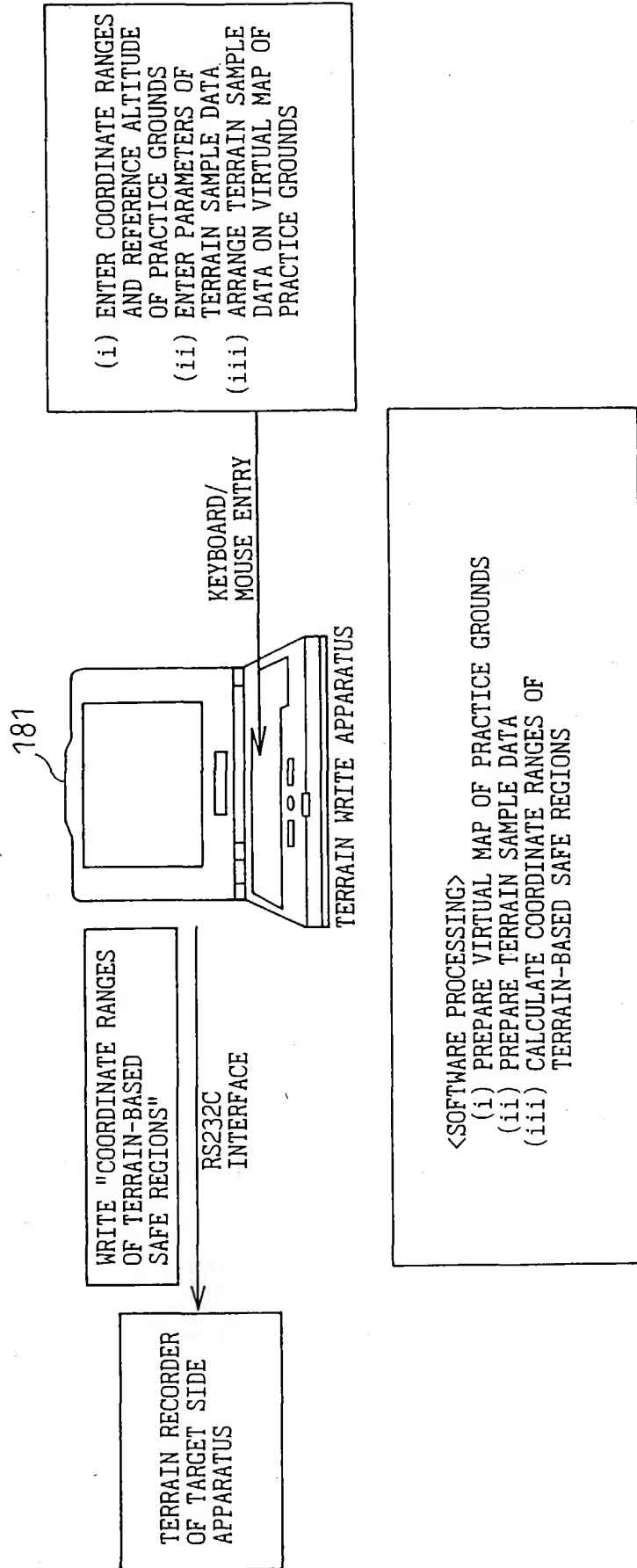


Fig. 19

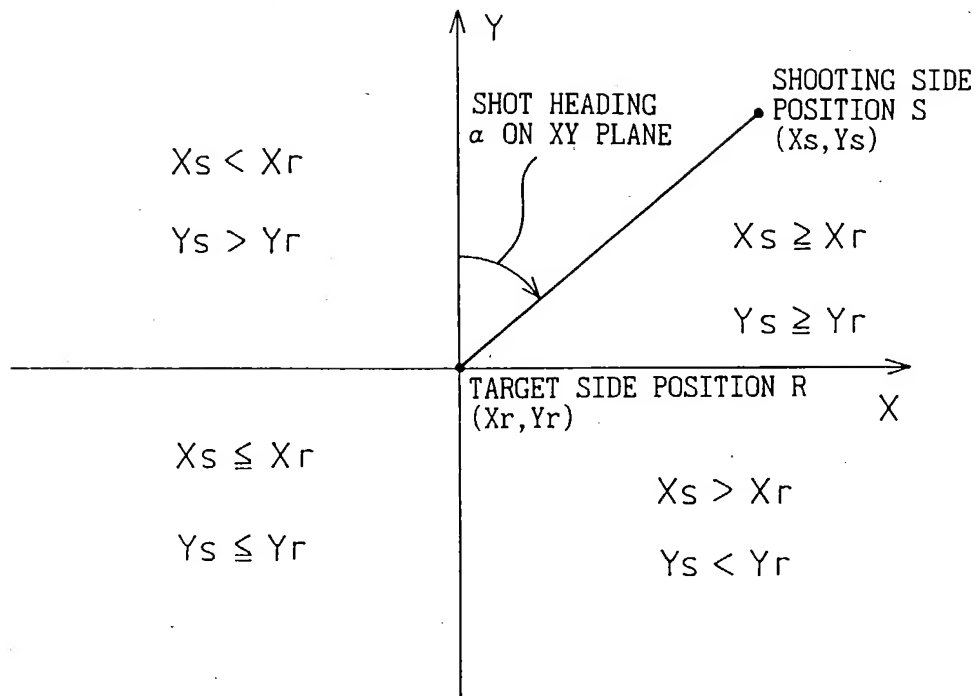


Fig. 20

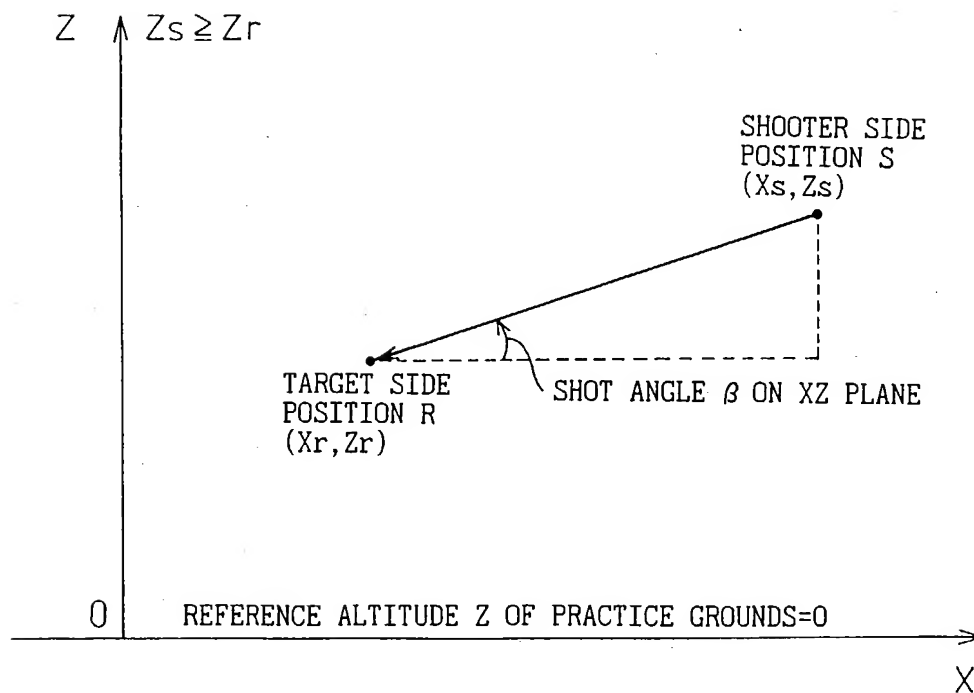
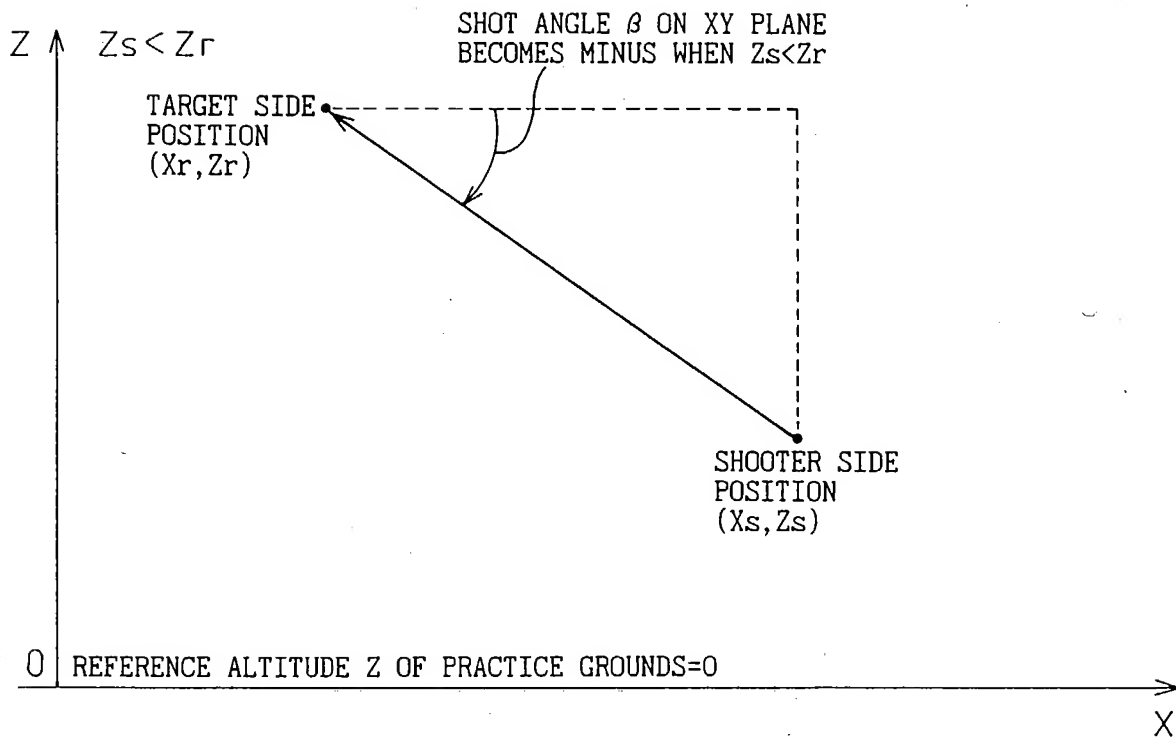


Fig.21



# Fig. 22

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CALCULATE DISTANCE  $D_{xy}$  BETWEEN SHOOTING SIDE AND TARGET SIDE ON XY PLANE WHEN TARGET SIDE RECEIVES SHOT LASER SIGNAL

$$D_{xy} = \sqrt{(X_r - X_s)^2 + (Y_r - Y_s)^2}$$



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CALCULATE IN WHAT QUADRANT ON XY PLANE SHOOTING SIDE APPARATUS IS IN USING POSITION OF SHOOTING SIDE ON XY PLANE AS ORIGIN 0

CONDITION	QUADRANT
$X_s \geq X_r$ AND $Y_s \geq Y_r$	1ST QUADRANT
$X_s > X_r$ AND $Y_s < Y_r$	2ND QUADRANT
$X_s \leq X_r$ AND $Y_s \leq Y_r$	3RD QUADRANT
$X_s < X_r$ AND $Y_s > Y_r$	4TH QUADRANT



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CALCULATE SHOT HEADING  $\alpha$  ON XY PLANE USING DISTANCE  $D_{xy}$  BETWEEN SHOOTING SIDE AND TARGET SIDE ON XY PLANE FROM FORMULA SET FOR EACH CORRESPONDING QUADRANT

QUADRANT	FORMULA FOR CALCULATION OF SHOTH EADING $\alpha$ ON XY PLANE
1ST QUADRANT	$\alpha = 90^\circ - (\cos^{-1} \frac{ X_s - X_r }{D_{xy}}) \times \frac{180}{\pi}$
2ND QUADRANT	$\alpha = 90^\circ + (\cos^{-1} \frac{ X_s - X_r }{D_{xy}}) \times \frac{180}{\pi}$
3RD QUADRANT	$\alpha = 270^\circ - (\cos^{-1} \frac{ X_s - X_r }{D_{xy}}) \times \frac{180}{\pi}$
4TH QUADRANT	$\alpha = 270^\circ + (\cos^{-1} \frac{ X_s - X_r }{D_{xy}}) \times \frac{180}{\pi}$

Fig. 23

CALCULATE SHOT ANGLE  $\beta$  ON XZ PLANE BY FOLLOWING FORMULA:

$$\beta = \sin^{-1} \left( \frac{(Z_s - Z_r)}{\sqrt{(X_s - X_r)^2 + (Z_s - Z_r)^2}} \right) \times \frac{180}{\pi}$$

# Fig. 24

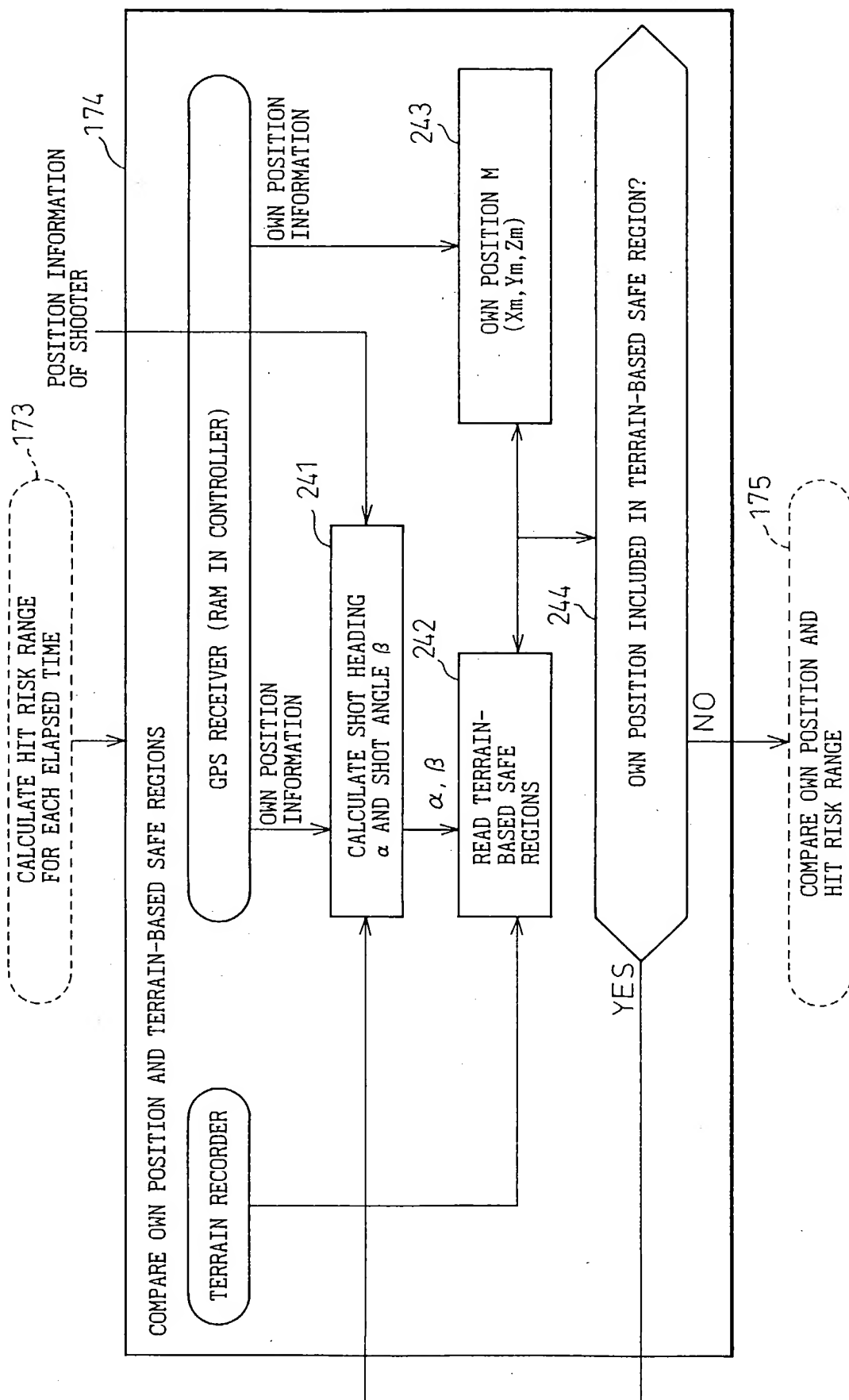


Fig.25

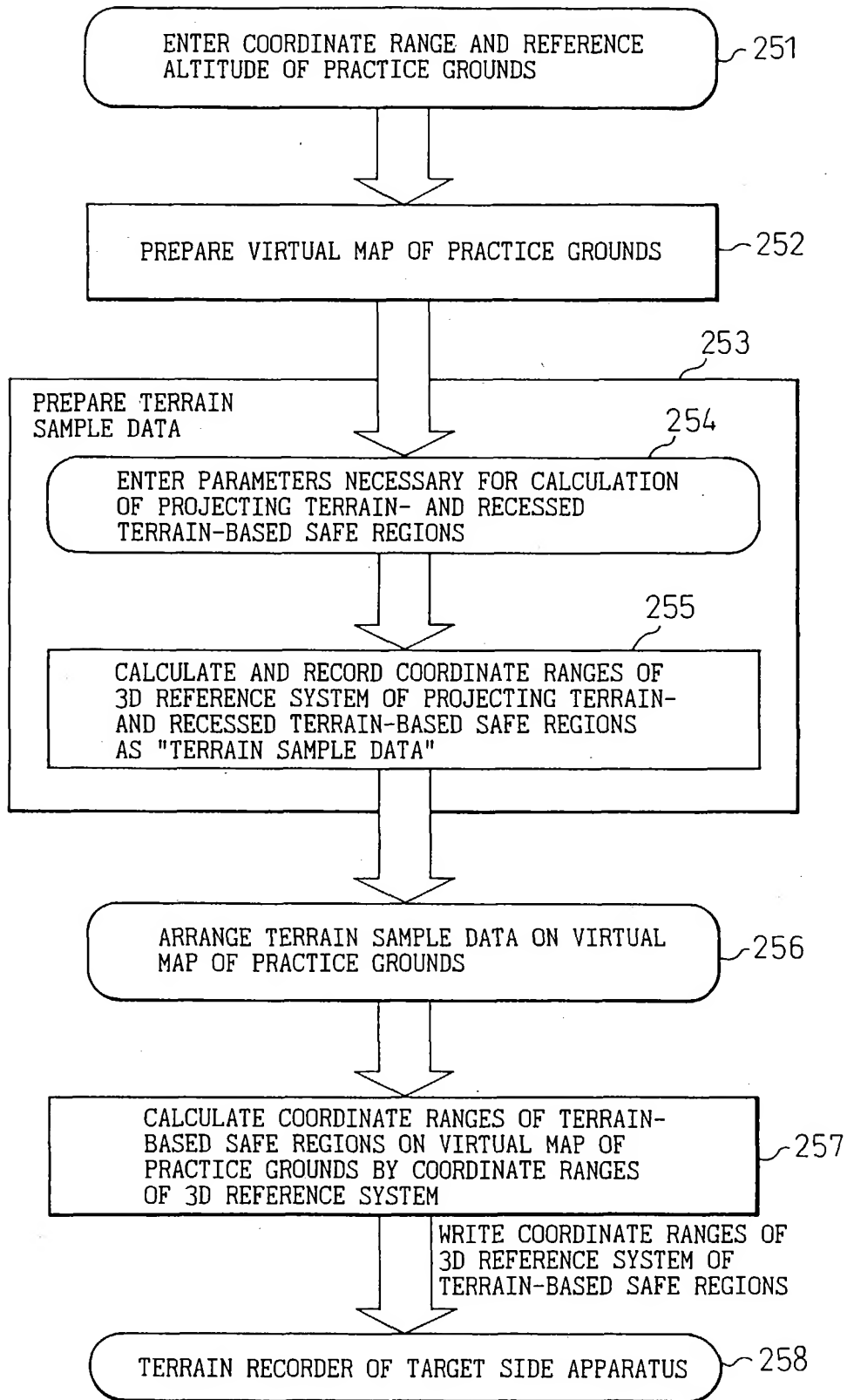




Fig. 26

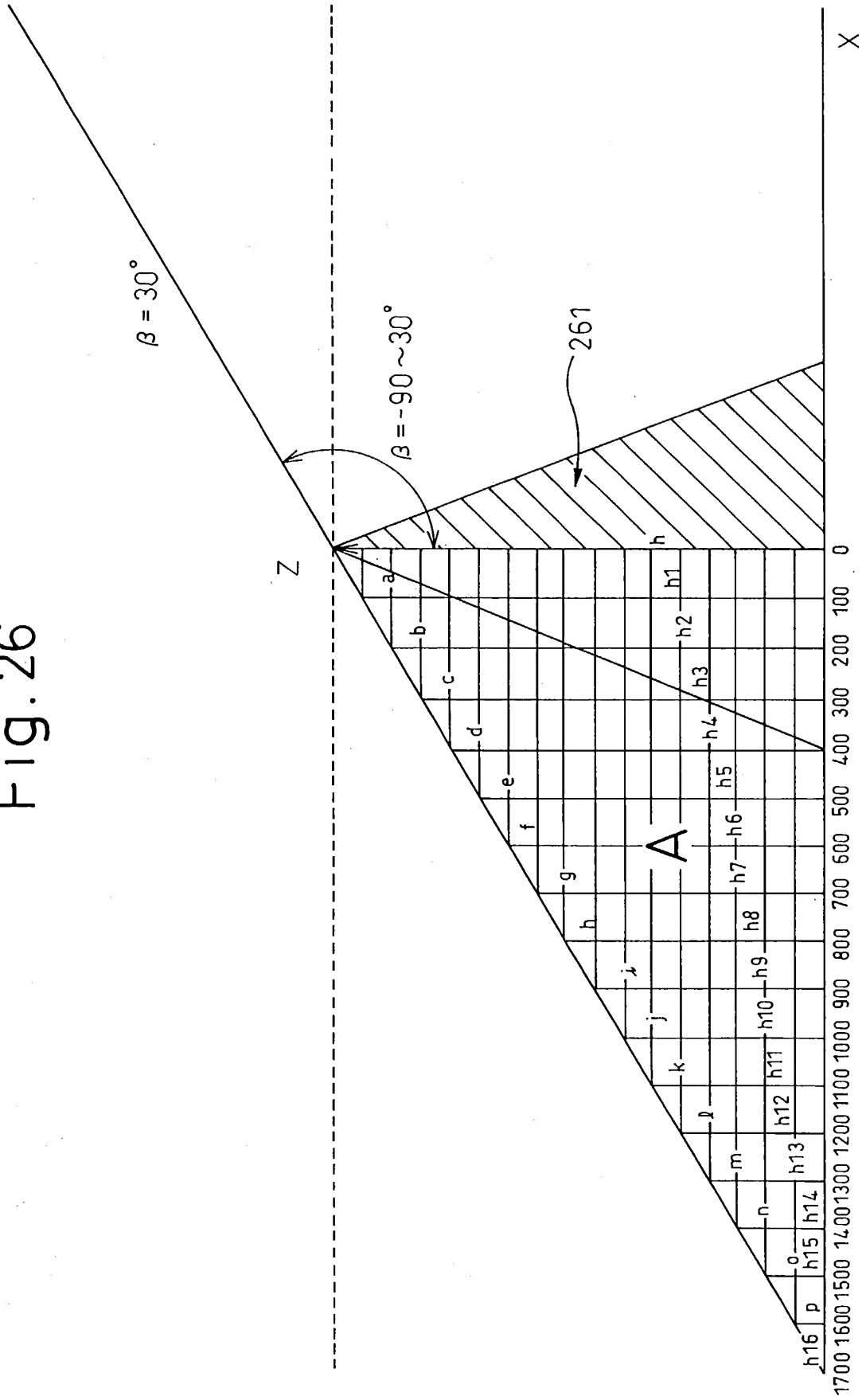


Fig.27

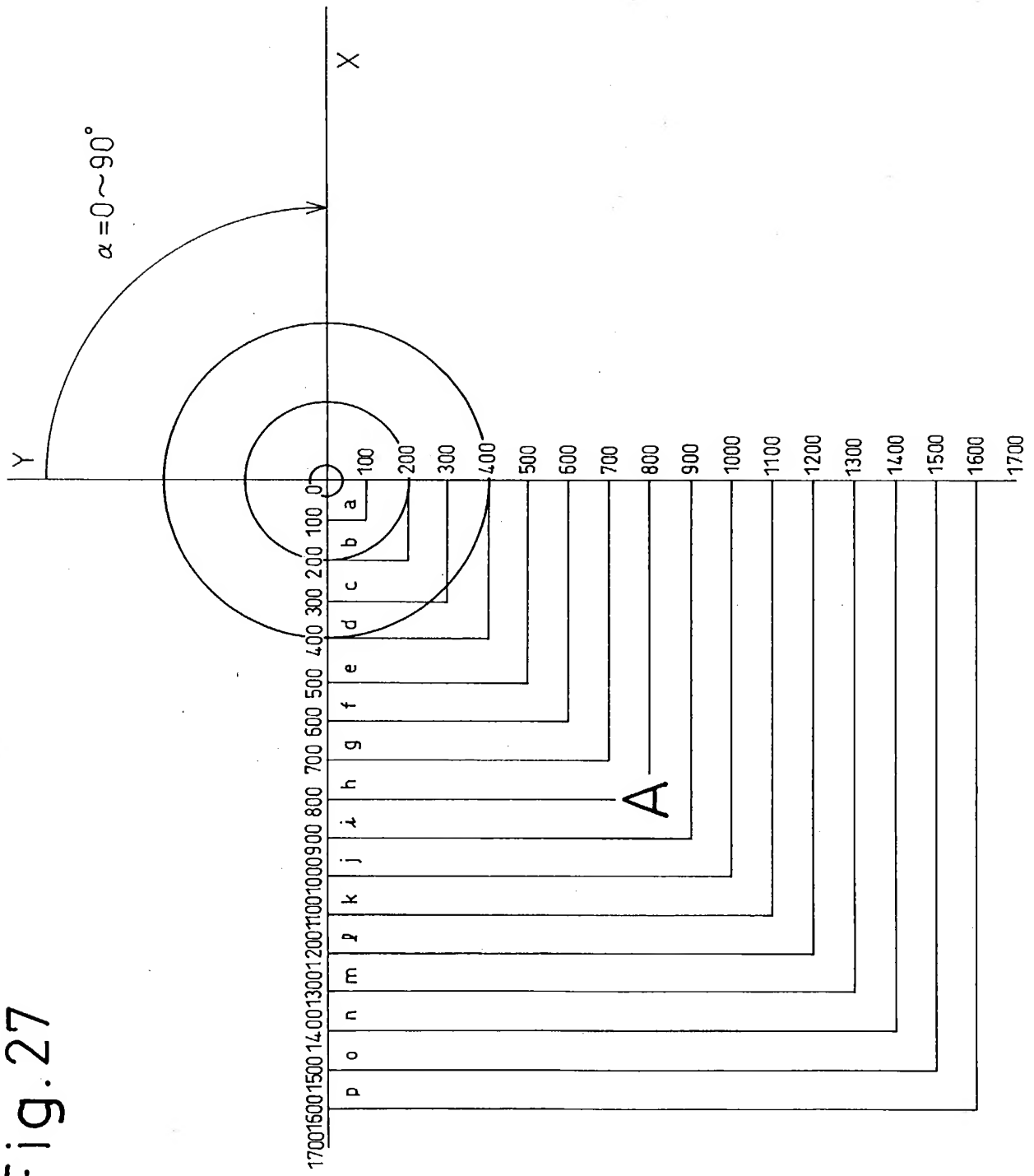


Fig. 28

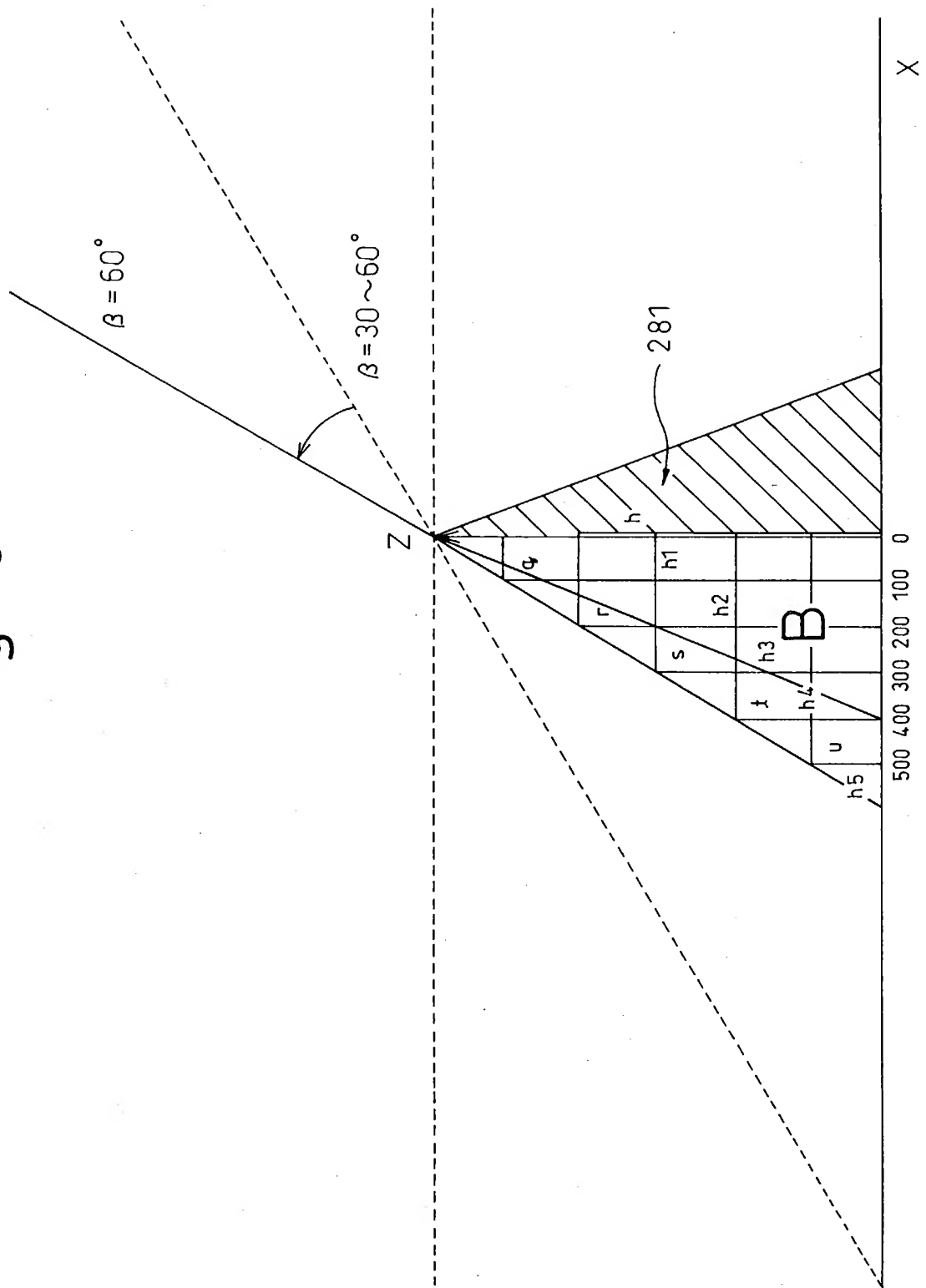


Fig.29

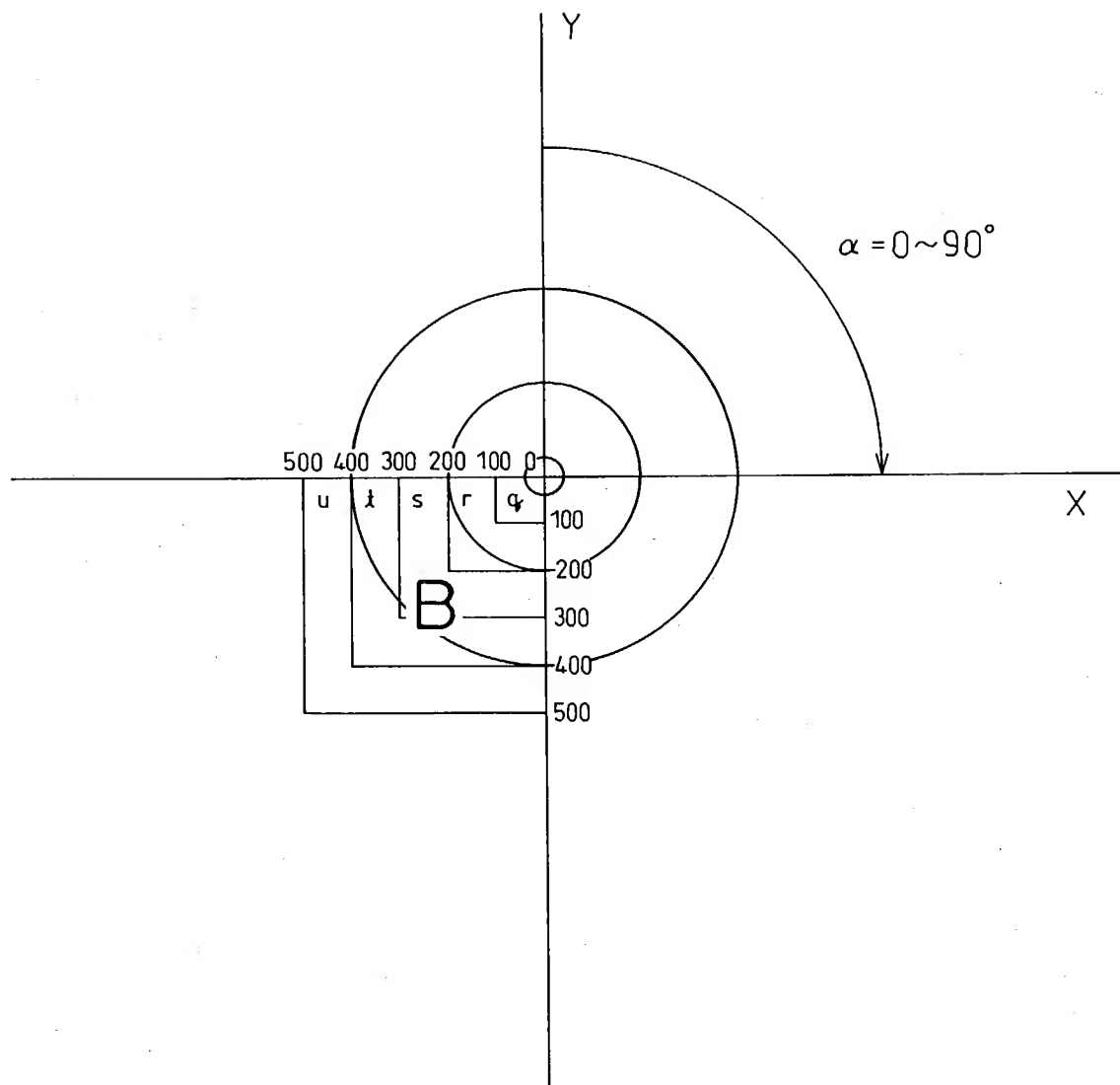


Fig.30

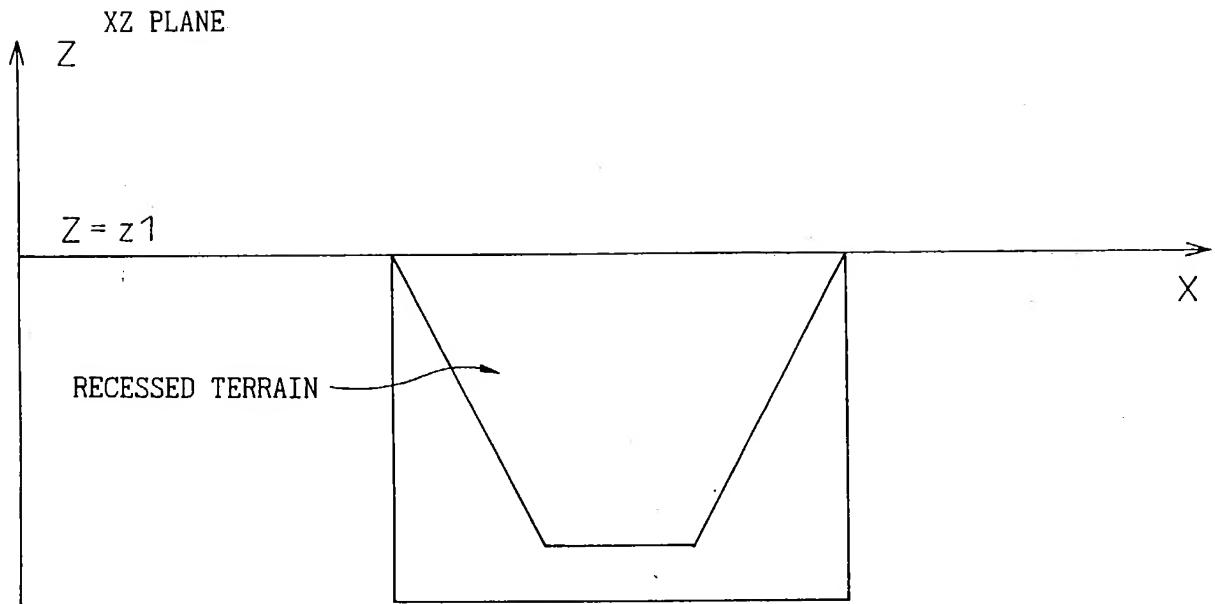


Fig.31

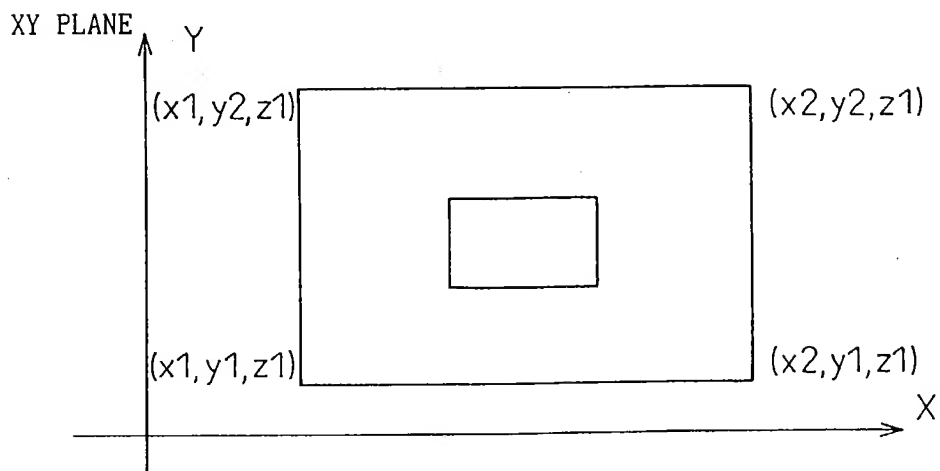


Fig. 32

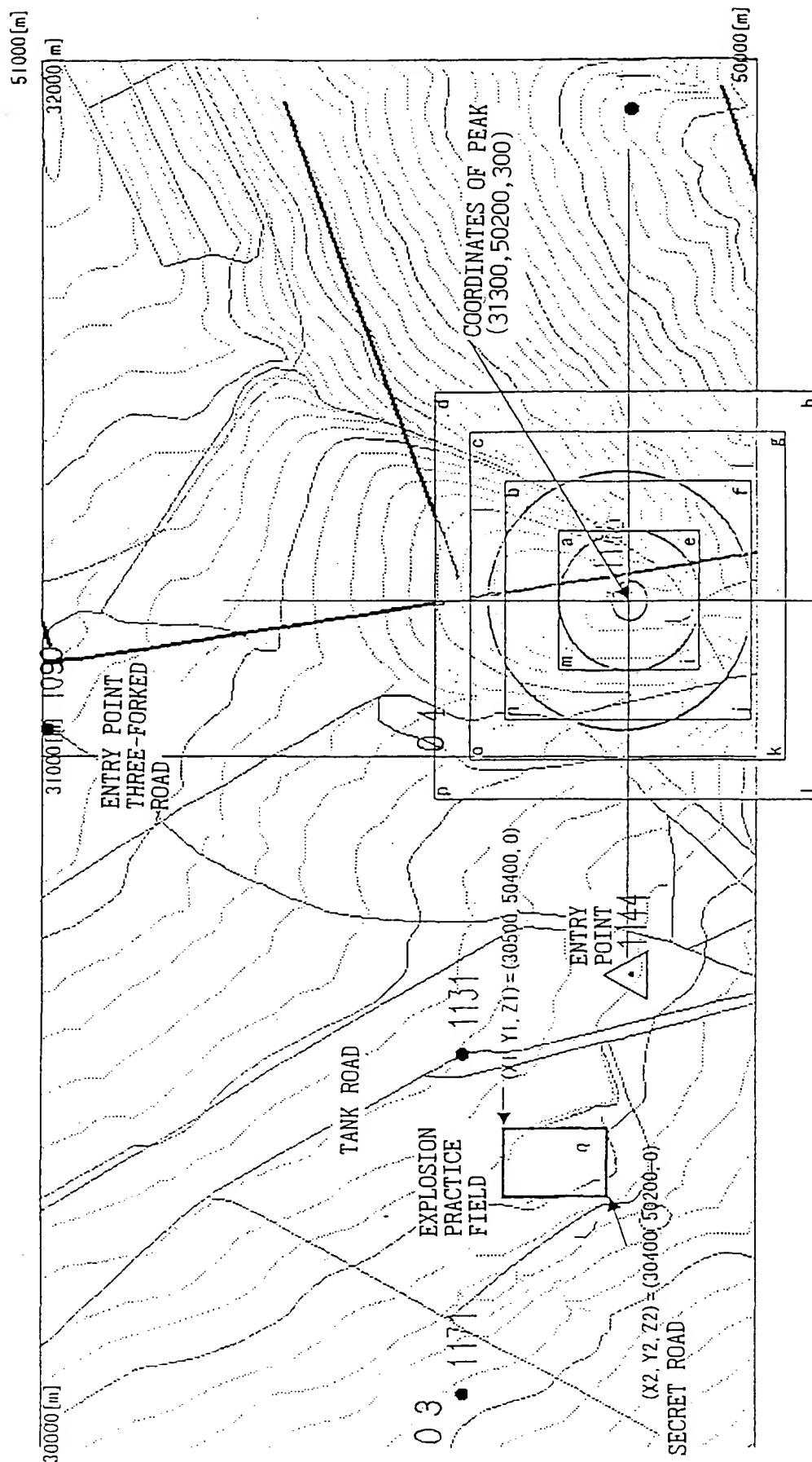


Fig.33

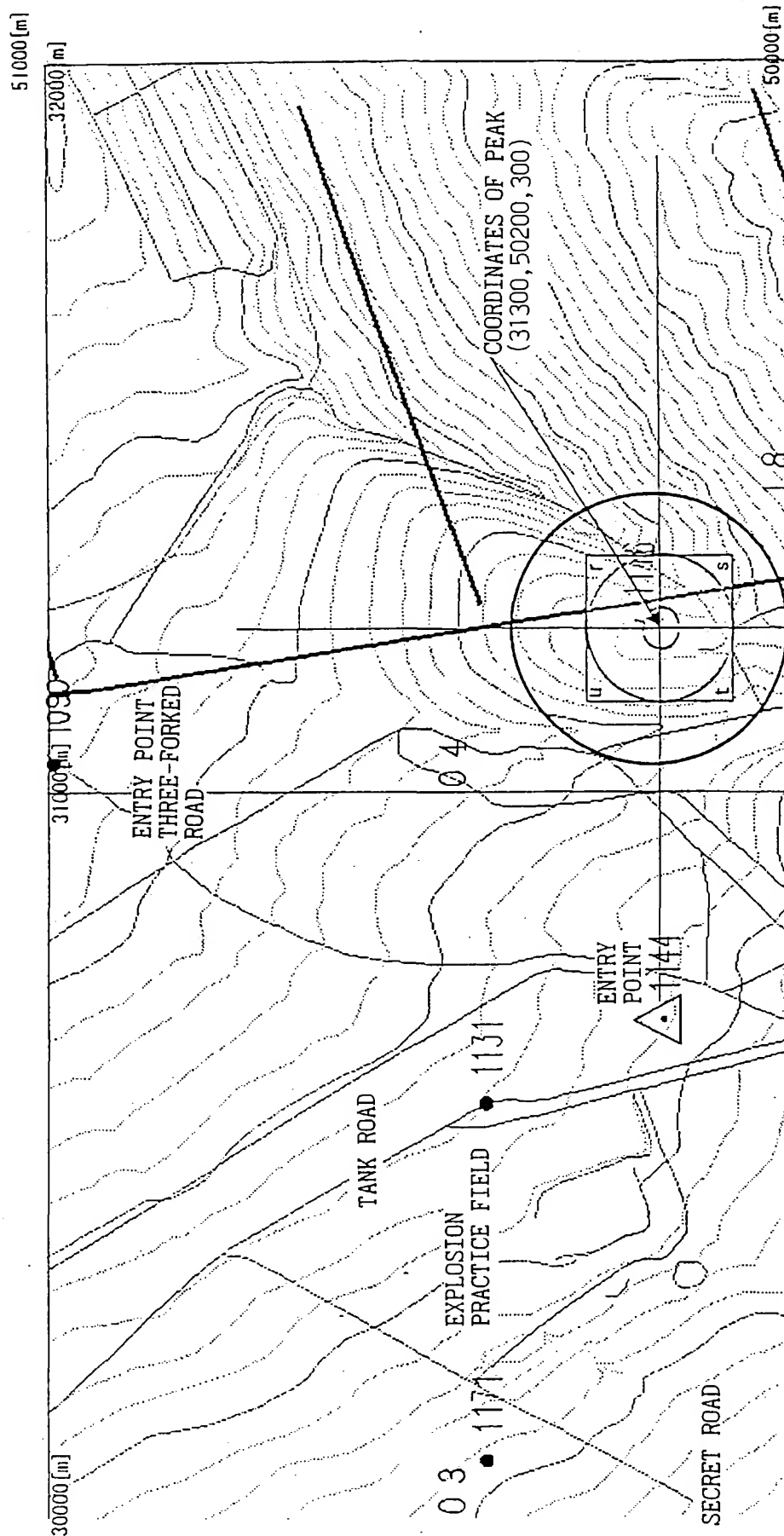


Fig. 34

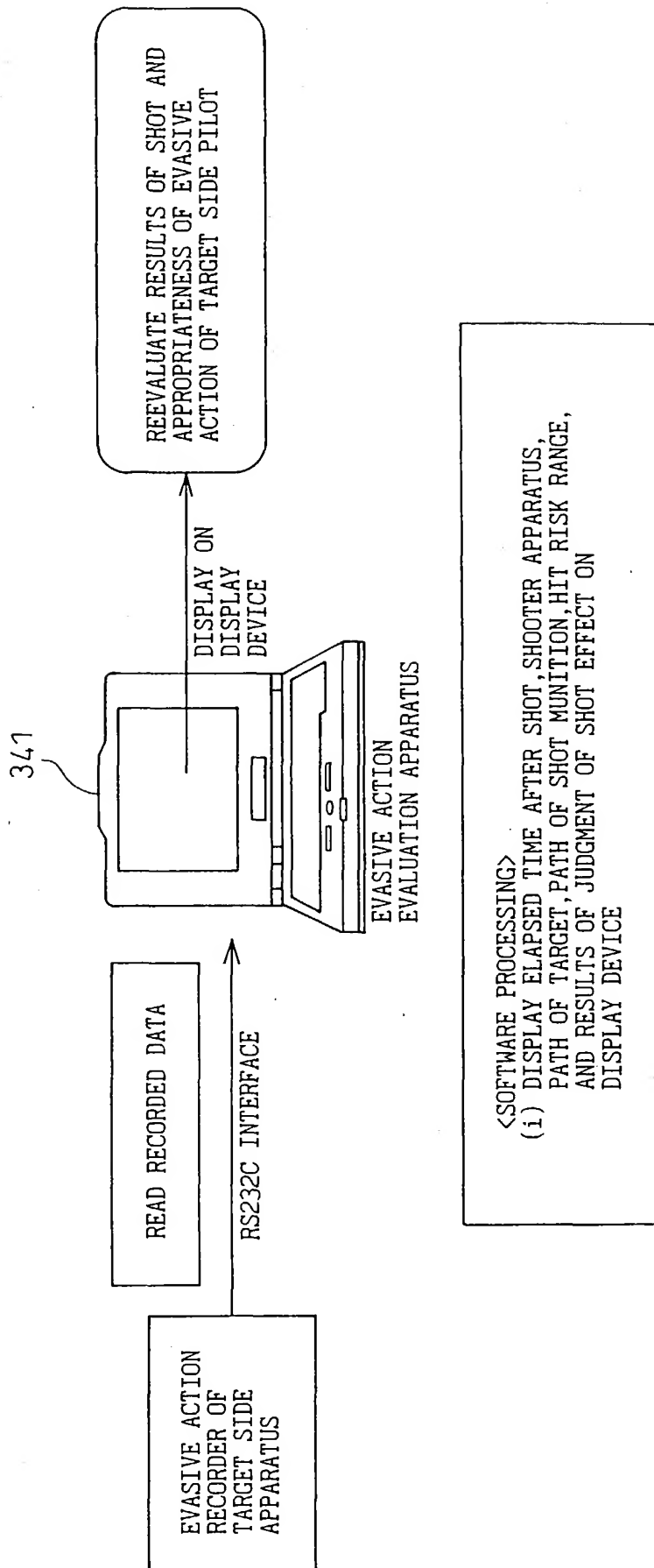




Fig.35

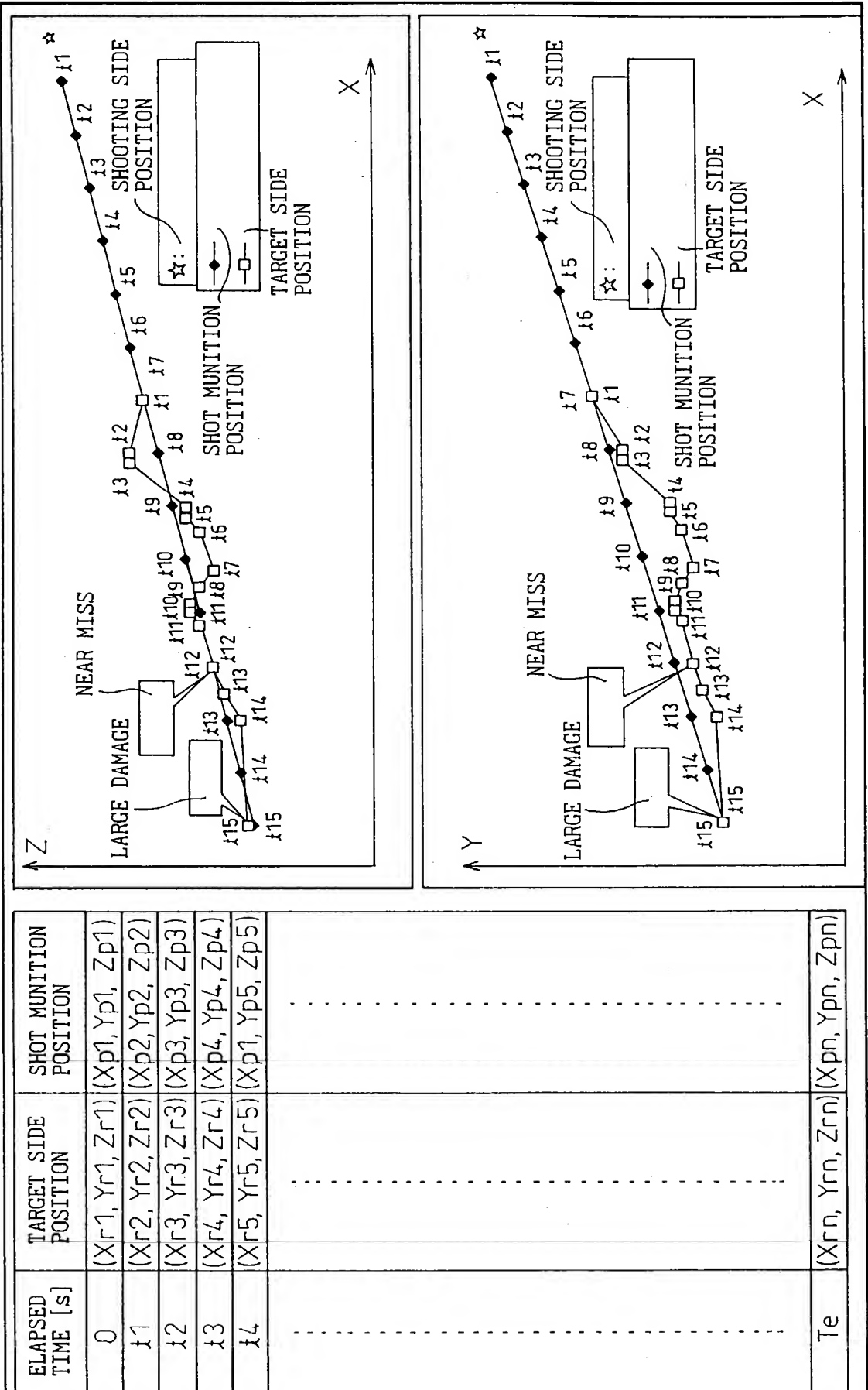
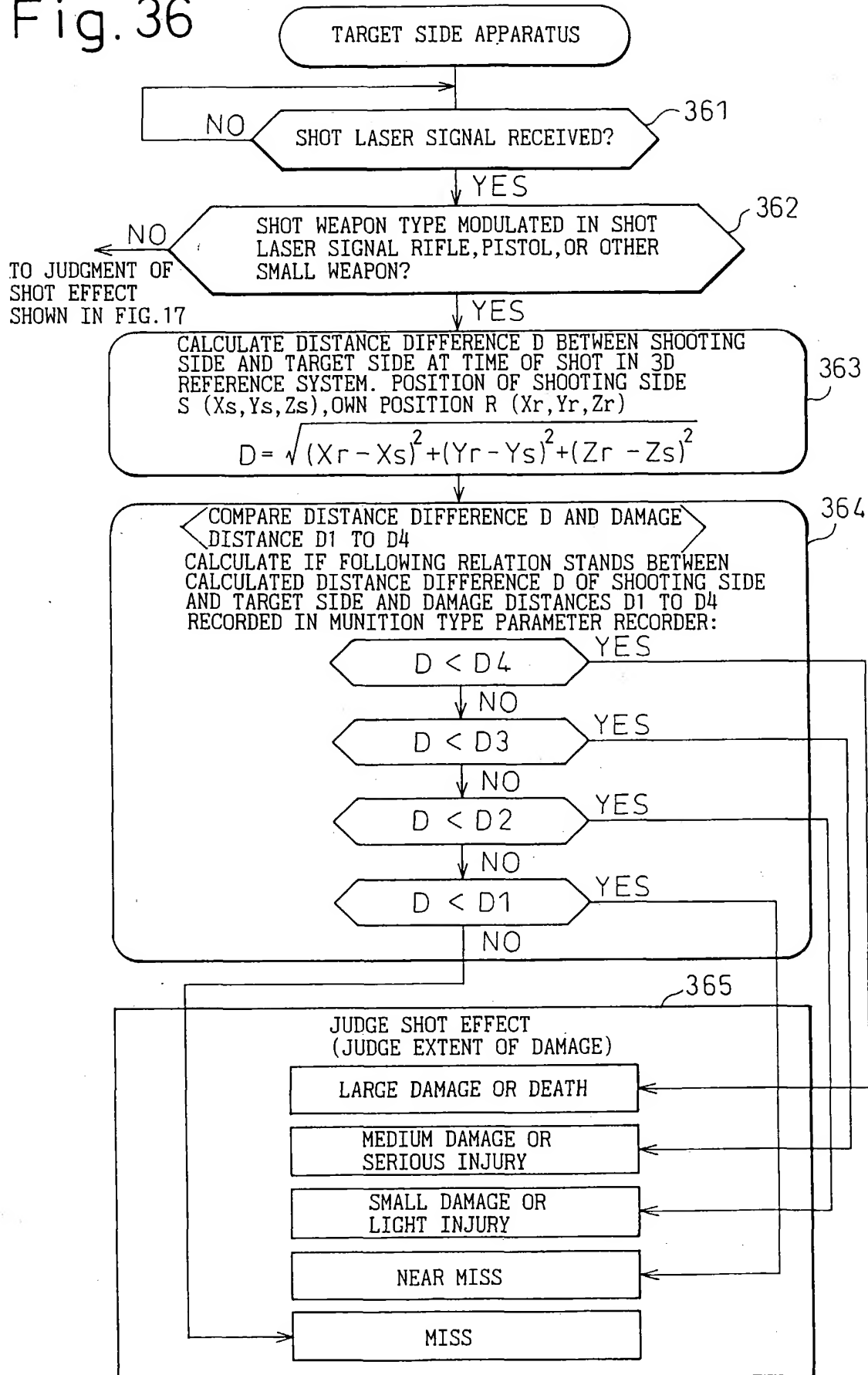


Fig. 36



# Fig. 37

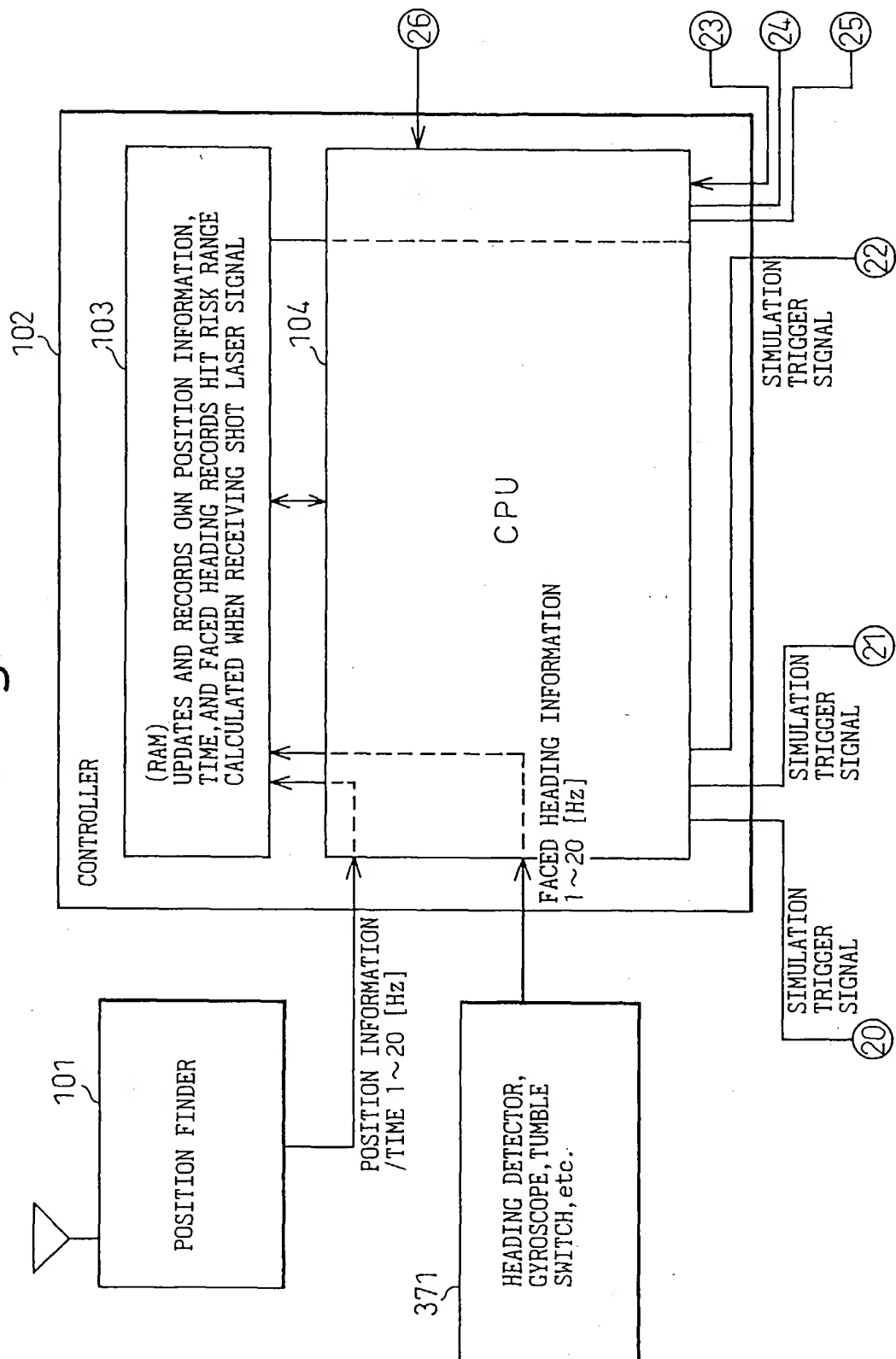


Fig. 38

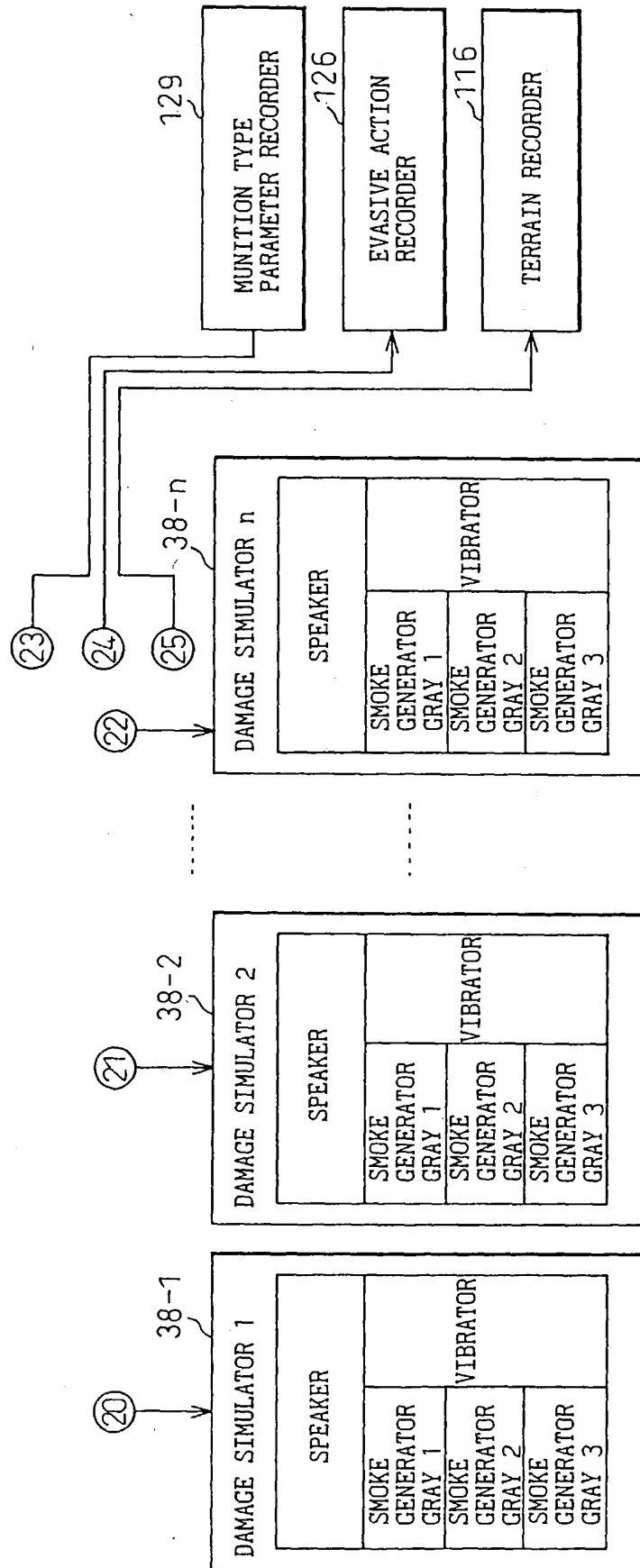
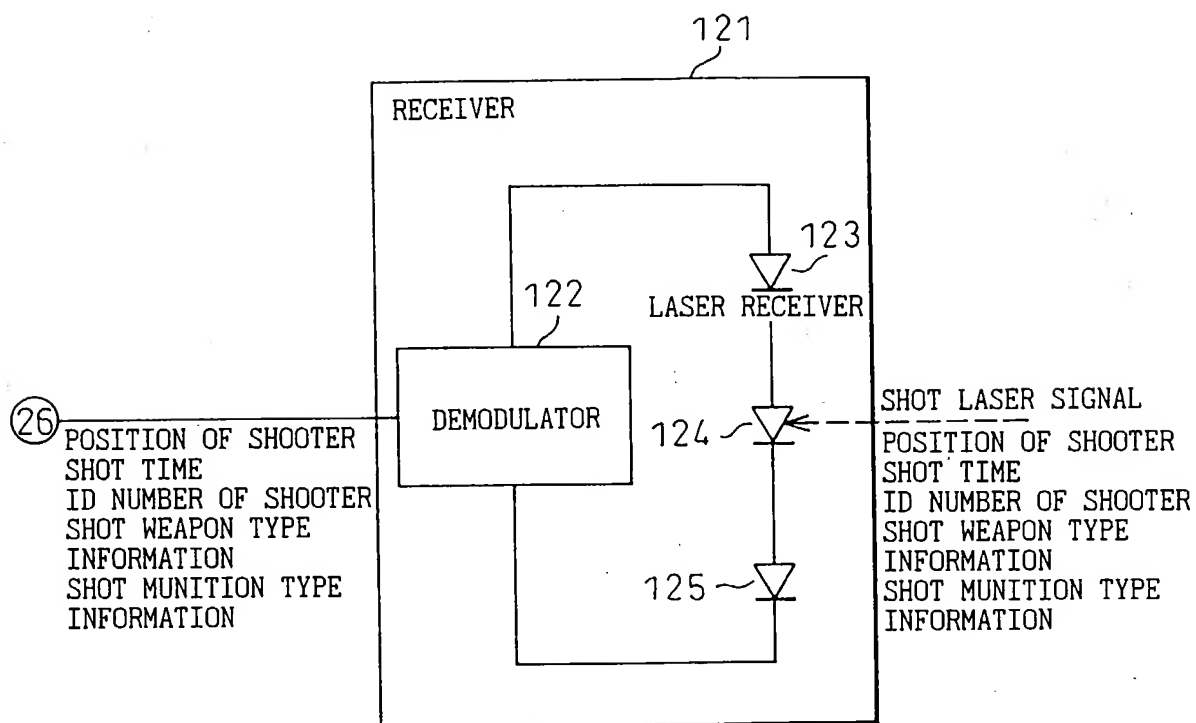


Fig. 39



# Fig. 40

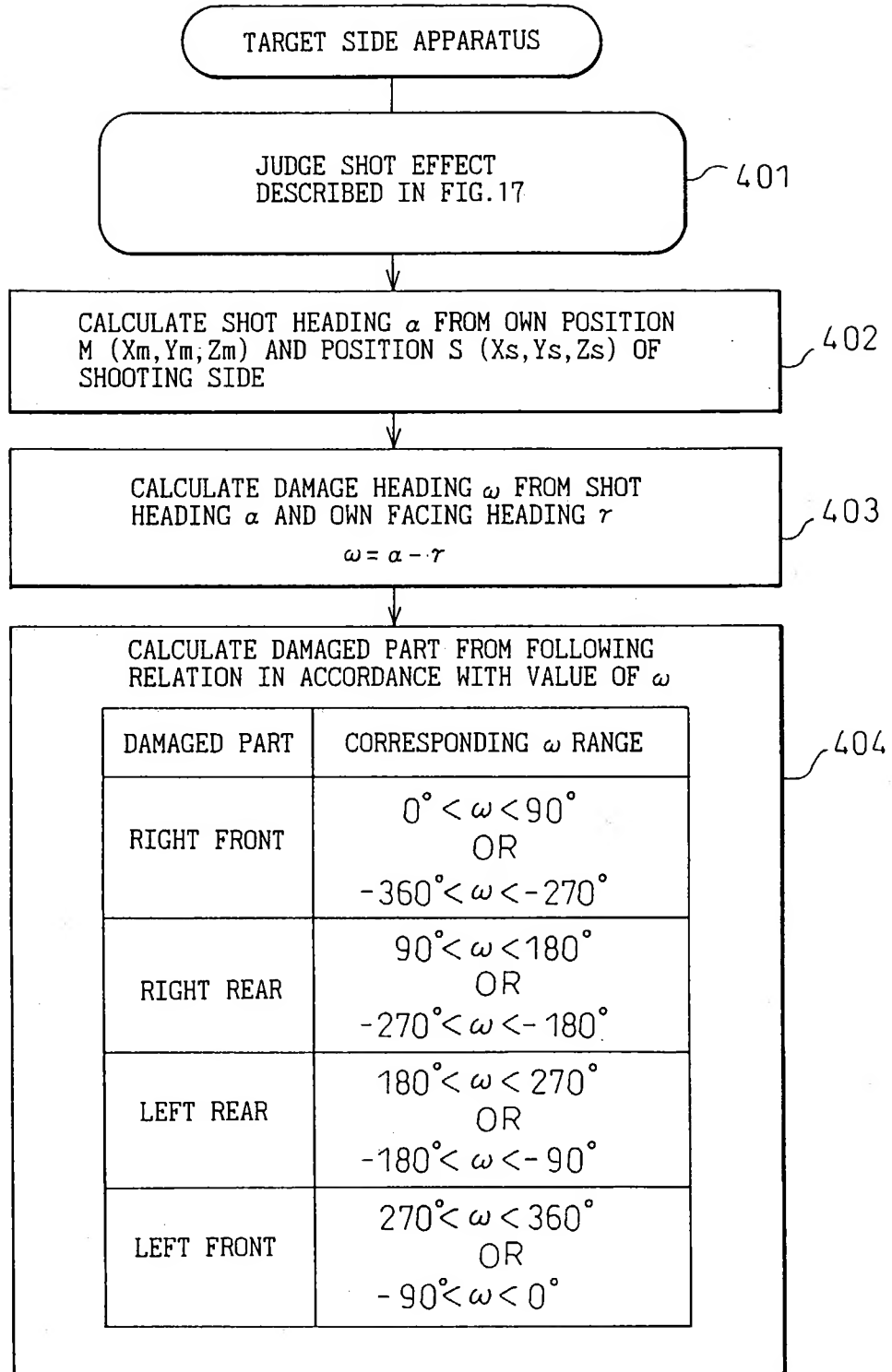


Fig.41

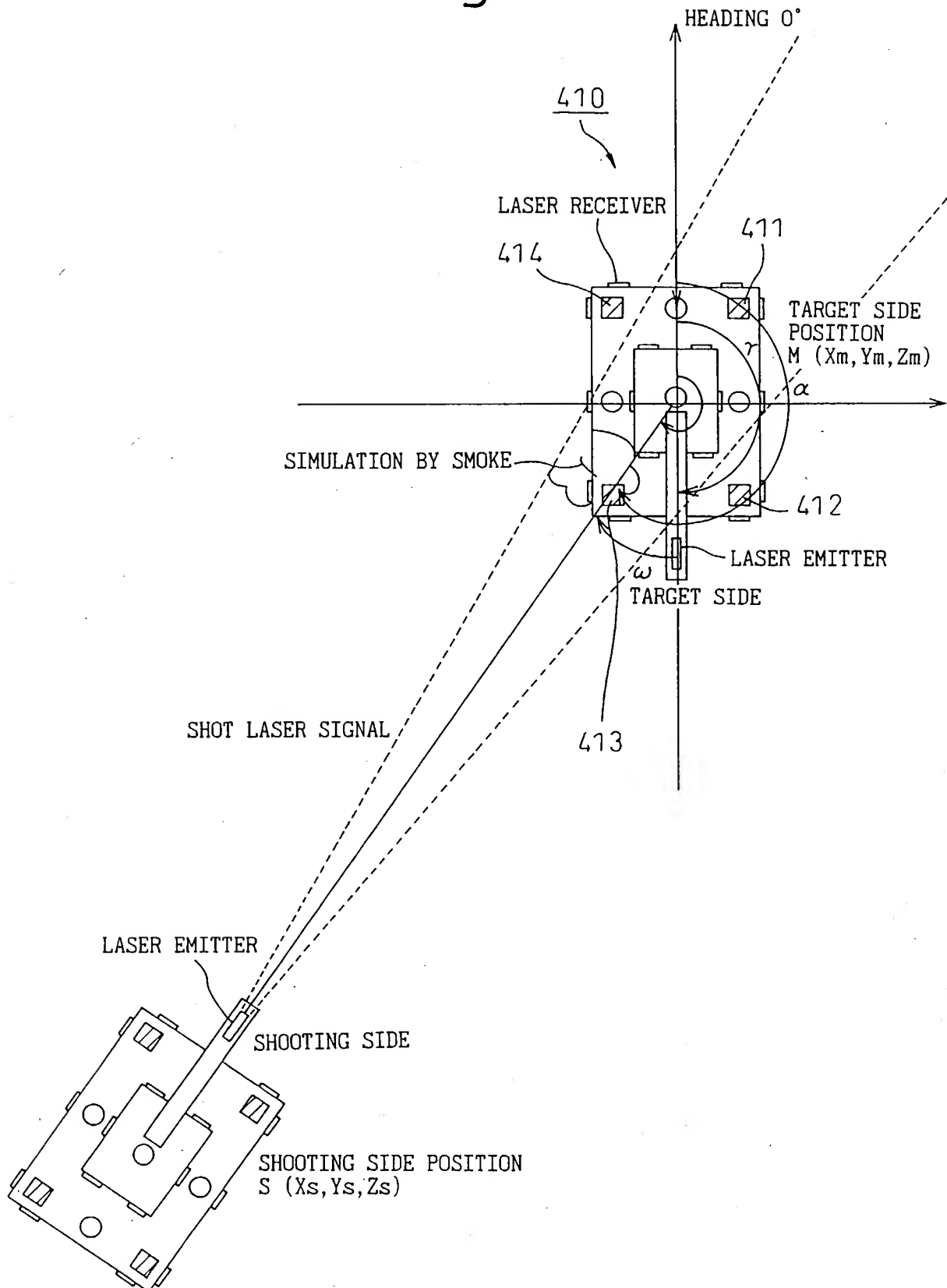


Fig.42

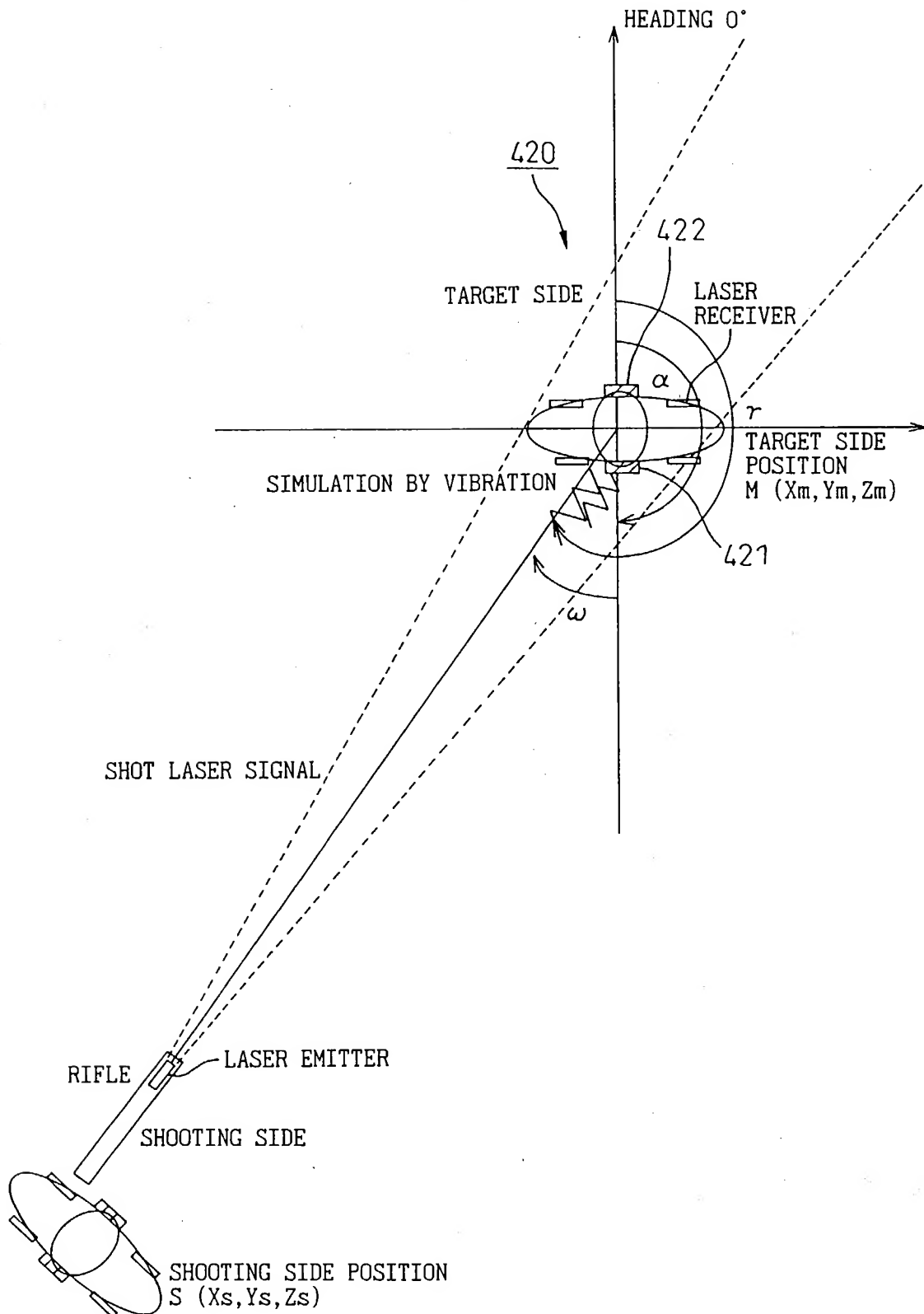
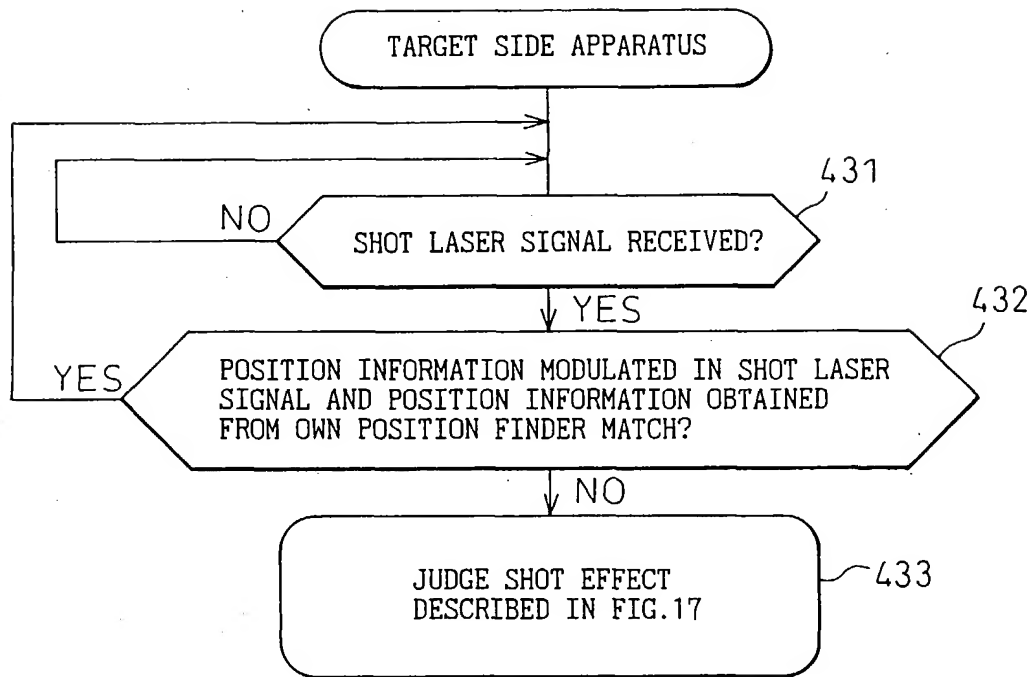


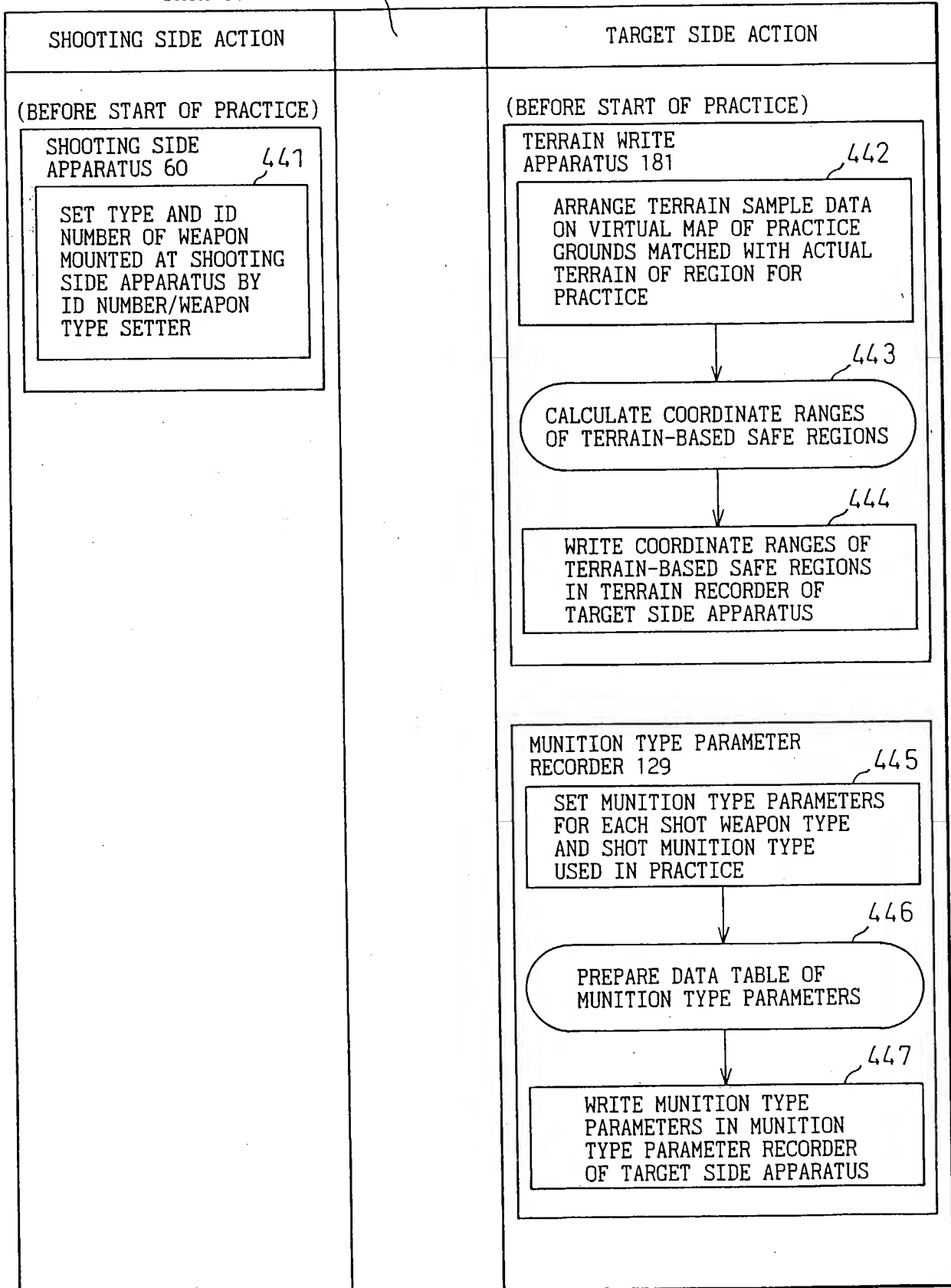


Fig.43



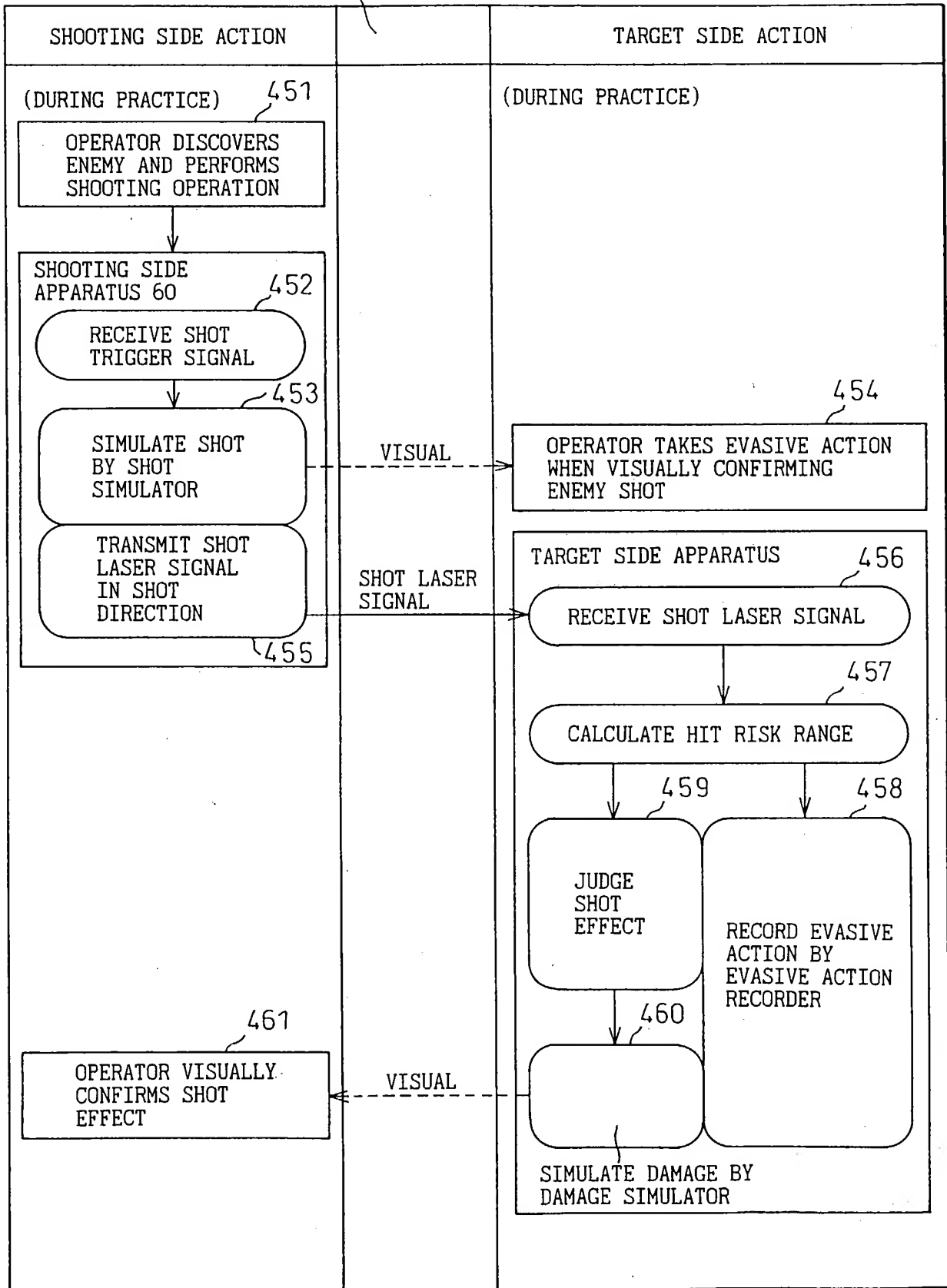
# Fig. 44

## DATA COMMUNICATION



# Fig.45

DATA COMMUNICATIONS



# Fig.46

DATA COMMUNICATIONS

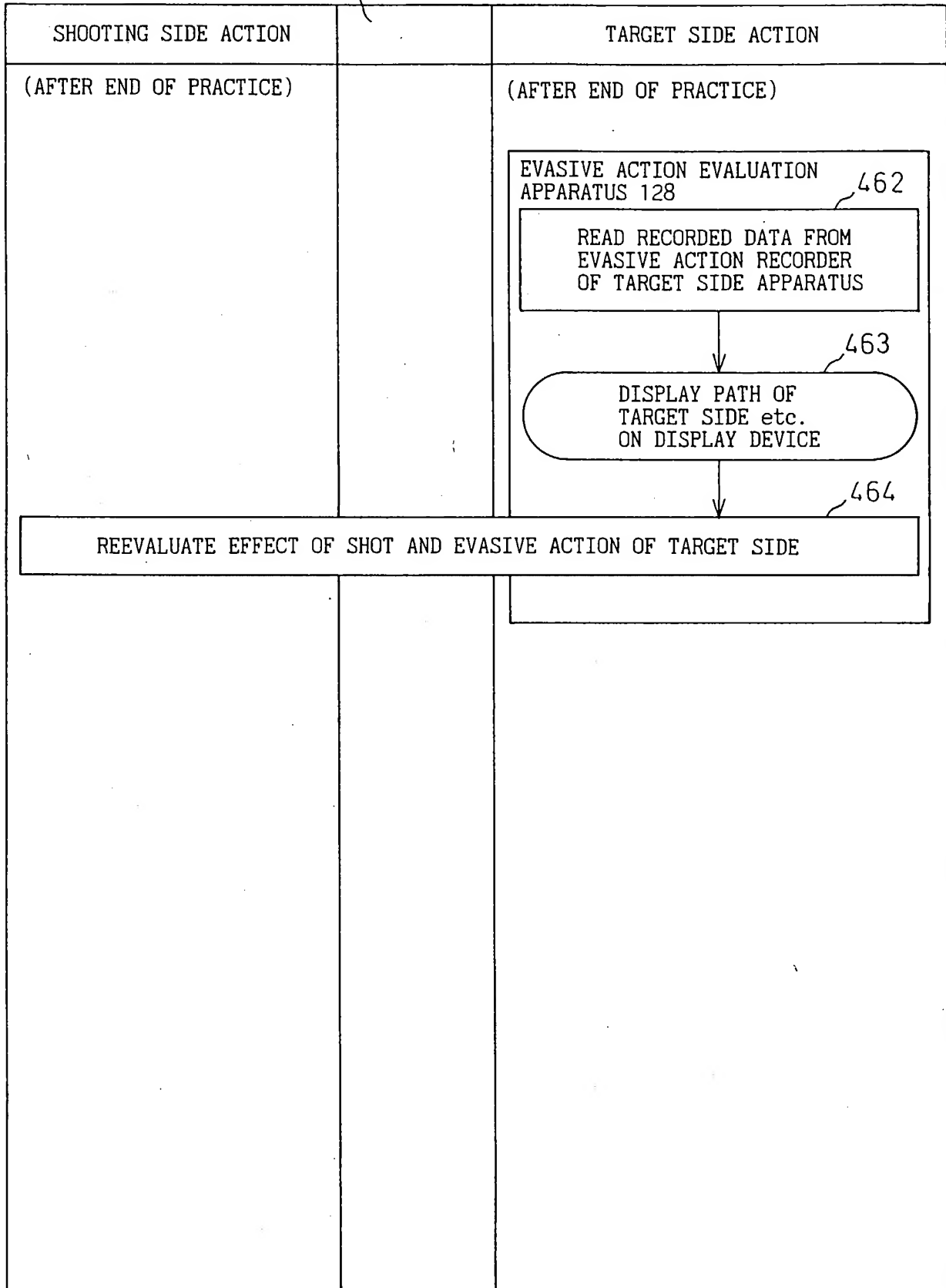


Fig. 47

